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THE JOURNAL

OF

ELECTRO-THERAPEUTICS

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ORIGINAL ARTICLES.

THE TREATMENT OF OLD PARALYSIS.

BY F. M. FRAZER, M. D., NEW YORK.

I wish to present to you the outline of a case which came to my clinic last winter, together with my treatment of it, and my reasons for selecting that course of treatment.

It is the case of a woman of about fifty, who, twenty-four years ago, while pregnant, burst a vessel in the brain, and had a well-marked crossed paralysis. When she came to me, the facial paralysis had disappeared, but the left limb was paretic and the left arm was practically useless, as her hand was not entirely under her control, and would open and close involuntarily. The contour of the arm was changed, probably on account of the unusual character of the exercise her muscles had in making these athetosic movements. Sensibility was intact.

As it was practically an incurable case, I gave an extremely guarded prognosis and started treatment. There was neither wasting nor reaction of degeneration, showing that the lesion was above the anterior horns of the cord, and thus according with our intercranial diagnosis.

Treatment consisted of running over the motor points with the interrupted galvanic—negative, of course—and static sparks.

My idea in following the motor points was that this would exercise the muscles normally and not in that eccentric manner they had exercised by her athetosis. If she could not control her muscles I could, and perhaps thus improve the contour of the arm. This, however, would do little toward benefiting the lesion in the brain. For that I trusted the static spark. To explain why I selected the static and its effect, I must digress into physiological psychology for a moment.

When an external stimulus acts on the end organ of a sensory nerve, a centripetal nervous impulse is determined (1) to the cord, (2) to the basal ganglia, and (3) to the cerebrum. If it goes to the cord it wanders about (in the path of least resistance, presumably) from cell to cell, and center to center, until it reaches a motor center which it stimulates. The motor center at once discharges, a centrifugal nervous impulse traverses the motor nerve connected with the center, and stimulates a muscle, which contracts. This is reflex action.

If the centripetal impulses reach the basal ganglia, we obtain co-ordinate movements, or automatism. The principle is the same, but the development is higher.

If, however, the centripetal impulse reach the cerebrum, we obtain a new factor: concatenated with the physical act is the psychical element of consciousness. This, of course, is in a normal person: if I stick a pin in your hand I expect impulses to travel to motor centers in your cord, medulla, and cerebrum, and so to stimulate these centers that they will discharge and send motor impulses to your muscles, causing them to contract in such a way that your hand is removed from the pin; you are conscious of what is going on.

Paralysis occurs physically when, owing to some defect n the conducting apparatus, the nervous impulses cannot be sent from the cerebral center, or psychically, when the nervous impulses cannot be started. With the latter we have no concern. If the path, however, be not normal—let us suppose a mass of connective tissue somewhere in the path—the nervous impulse should travel as far as the lesion, if the rest of the nerve be perfect. Nervous energy does not, like electrical, require a complete circuit. If, then, I stick a pin in your hand, which you feel, and you cannot voluntarily remove the hand on account of a mass of cicatricial tissue somewhere in the motor path, the nervous impulse, according to my idea, should precipitate itself against this barrier.

Now, "it is a fundamental law of biology, that the constant execution of definite functions effects certain structural modifications." Is it then too sanguine to hope that, by bombarding the barrier with motor impulses, we may be able eventually to get through it, or to make a new path around it?

Such was my idea—in this case, as the lesion was central, the reflex and automatic acts were unimpaired. The sensory apparatus was intact. In order to know that I had a strong impulse I gave sparks, which caused pain. Pain, the negative tone of a sensation, is a purely psychical phenomenon. Therefore, when it hurt, I knew that my impulse had reached the cerebrum, and knowing that the instinct inherited from countless generations would teach the patient to remove the hurt part from the place where it was being hurt, I assumed that an impulse would start back over the imperfect motor path.

Now, it may be argued that, after twenty-four years of disuse, the motor impulse would not travel that path at all; that years of disuse would have caused it to disappear completely, and that the effect of my irritation would appear on the opposite side—or elsewhere. In a complete paralysis, this seems probable; in my case, however, the paralysis was not complete. She could move her arm voluntarily, but not always as she wished to move it. There was still some motor path connecting the cerebrum with the extremity, since she had some control over her muscles. Be it what it may—a few fibers which escaped the scar, or a new path around it—the path was present, since she *could* move her arm at will, and it was inadequate, since she had not complete control. If now I could send a series of impulses on that path stronger than she could send, voluntarily, would I not be able to effect sufficient structural change to ameliorate her condition? The only way to find out was to try.

I tried the experiment—treatments usually three times a week—for several months, and there was material improvement. Subjective, as she said it gave her less trouble; objective, as she can now turn her hand, whereas I had to turn it for her.

I make no claim for originality in this treatment. I think that it is but a modification of Rumpf's method. He used faradic stimulation of the peripheral nerves—though I do not know whether our conclusions were reached by similar lines of reasoning or not.

The scope of the method is yet to be investigated. Would the sparks ameliorate a complete paralysis? Would there be any result if the lesion included the sensory path above the trophic center? And below?

These, and many other questions, I cannot answer. Perhaps some of our members can throw light on the problem in the discussion.

Discussion.

THE PRESIDENT: I would like to state that we have present one of our honorary members, Mr. Max Osterberg. We extend the courtesy of the floor to Mr. Osterberg and to all others that are not members of the Society. The paper of Dr. Frazer is now open for discussion.

MR. MAX OSTERBERG: Mr. President, the greatest part of the subject which Dr. Frazer has treated is practically new to me, but there is one point which is of considerable value and easily grasped from the merely physical point of view, that I would like to make. Dr. Frazer spoke of the bombardment. We have in electricity, just as we have in sound and in a number of other phenomena, what we call resonance; you are all familiar, I presume, with these phenomena; for instance, a string on the piano will vibrate if the proper tone is struck on an organ, and that is simply due to resonance; that is, we set the air into vibration, in consequence of which the particular note is struck and it commences to vibrate. There are a number of theories which have been brought out by some of our eminent electro-mathematicians (if I may call them so), who think that the effect of electricity on the human body is, to a great extent (especially when applied in the form of sparks), due to that peculiar resonance. Now, if Dr. Frazer succeeded in improving the condition of the patient, might it not very well be that at such times the stretched nerves or arteries or veins were caused to vibrate in such a way as to respond upon the rest of the body? In that way you might kill one person on the electric chair very much more rapidly than some other person; that is, if the nerves commenced to respond, the very first instant might tear the tissues to pieces; otherwise it might take quite a long time. I have heard physicians say that the most courageous men that go to the electric chair are killed the most quickly. Whether this is due to the peculiar strain to which they put their nerves I do not know; but it seems very likely; a very nervous person will not be killed quite so quickly. Furthermore, very strong persons will be able to stand but very little of the electric current in comparison with very nervous persons. We know of cases where, for instance, a strong, healthy motorman, who had been used to handling a 500-volt current, was nearly killed by a 500-volt charge, while a very nervous person, who was very much afraid of it, did touch it and was not hurt at all. These seem to be particular conditions of the nerves, and I should like to hear an expression of opinion from physicians as to the possibility of such reactions upon the human tissues. It seems to me that is the most interesting point of view.

Now, referring to Dr. Norton's paper, he spoke very highly of the character of Ohm and of his work. Of course it is understood that he is the fundamental starting point of the entire science of electricity, but there is one particular point which has not been mentioned: Ohm's law, as it exists to-day, is being treated by the physicians wrongly, I believe; that is, that the current is equal to the electromotive force divided by the resistance. This law is not true without modification. Just as soon as we have an alternating current, there are other points to be considered. One of these is induction; that is, the peculiar action of one current working on another. It must be deducted from the original electromotive force, in order to make Ohm's law applicable. I think there is a vast field for study of the actions of the currents on the human body. The voltmeter and the milliampere do not always tell you what the current flow is through the various parts of the body.

Dr. William H. King: This paper of Dr. Frazer's it seems has struck upon a very important point, that is, the localization of electricity upon the central nervous system. It has been a mooted question for a long time in electro-therapeutics whether it is possible to penetrate the bony coverings of the spinal cord and brain with the electric current. It was claimed long ago by Remak that it was possible to penetrate the bony cranium and concentrate the action of the current upon the brain: and in proof of this he cited the various physiological phenomena upon the various centers, such as those on the eye, taste, etc. This, however, was refuted not long after that by Althaus, of England, who demonstrated that it was impossible to produce any such action upon the brain if the fifth nerve was paralyzed. He found, in cases where the fifth nerve had been cut by accident or in surgical operations, where the cut ends had separated and not united, that it was impossible to produce these various phenomena. He therefore concluded that the only action that the galvanic current or any other current had upon the brain centers was not by penetrating the bony cavity but by reflex action through these nerves. Now, this is exactly the same point which has been brought out by Dr. Frazer. He made use of peripheral treatment for the benefit of central lesions. He did not give it through the brain, but gave it simply to the parts which were supplied by the cells that were involved in the central lesion. If this is the case, if we find that the nerves conduct the electric impressions back to their origin, we have solved one of the greatest problems in localizing our treatment upon these central lesions; but whether it is a fact or not is yet to be demonstrated. For instance, you take bodies that have been electrocuted at Sing Sing; we find that the nerves do not conduct the electric current, that the electrolytic action is not along the nerves, but is, in reality, along the blood vessels. We find that the nerves are uninjured, while the blood vessels have been largely destroyed.

Now, this brings up another question: if they do not conduct the current in that way, is it possible that they conduct it in another way, as suggested by Mr. Osterberg. I believe that one theory, among many others, for the electric current is that it is vibratory motion. We know that in osmosis if we have a certain fluid that has a certain vibration, it will go through certain membranes which have the same amplitude and rapidity of vibration, but it will not go through other membranes ; and it is this common amplitude and rapidity of vibration that gives different membranes their selective power in what we know as osmosis. Is it possible that there is a certain vibratory motion along the nerves, and does that vibratory motion correspond in resonance to the electric current, and consequently while the vibratory motion and impulses may be conducted up the nerve, is it conducted in such a way that it does not produce electrolytic action, and the electrolytic action only takes place where the vibrations are not in unison with the vibrations of the current? That is a question on which I think we could put a great deal of study. The only question is if the nerve does not conduct these impressions in this way, is it possible for us to concentrate any action of the current upon the central nervous system. Upon the spine I believe it is possible, for there the blood vessels which enter through the foramina, both in front and back of the spinous process on either side, I think are good conductors, and we know from the wonderful results which are sometimes obtained by administering electricity direct to the spinal cord that the current acts sometimes through the spinal cord; but I do not believe that it has been demonstrated yet whether there is an action upon the central cells of the brain, except through this conduction of some material impulses through the nervous supply. I would like to ask Mr. Osterberg if this is the idea which he had in mind.

Mr. Osterberg: In referring to action on nerves in electrocution I committed an error ; I should have said blood vessels, instead of nerves. Dr. King's explanation on resonance effects is perfectly correct, but might be made a little more general. We can strike resonance not only by obtaining the same number of vibrations per second, but also by just three times, five times, seven times, etc., the number of vibrations.

Dr. F. A. Gardner: This is entirely new to me. I just wish to ask Dr. Frazer how he uses the static electricity, whether with the jar or with the direct spark.

Dr. Frazer: I used the spark locally. I did not attempt to treat the leg after the arm. I went all over it with the galvanic first and then with the static, taking one ball—insolated, and drawing the spark from another, going all over the arm. I do not believe I got the electricity to the brain. My idea was to cause a strong peripheral irritation, strong enough to make the patient suffer pain, not too great, but enough to cause actual pain; then I knew that some change took place in the brain through the stimulus that I had given, and I knew it had reached the brain because it hurt; after reaching the brain I thought we would get another impulse, entirely nervous, coming back—a centrifugal impulse—and I hoped by sending this motor impulse over the nerve, that it would effect some structural change; I think it has to a small extent; the case is still under treatment.

Dr. W. H. King : I would say that I saw this case come in the the clinic, that it presented apparently all the indications of a former apoplexy with descending change; it presented the characteristic appearance that there had been some kind of a lesion, not in the cortex of the brain, but in the fibers, the white substance of the brain, which had gone on and produced a descending change down along the lateral columns of the spine. Now, is it possible that the treatment did not extend beyond the lateral columns of the spine? Is it possible that the change manifested there was only manifested in the lateral columns and did not reach the central lesion?

THE BASIS OF ELECTRO-THERAPEUTICS.

BY CLARA E. GARY, M. D., BOSTON.

Electricity has become a necessity during the past few years, both to the specialist and to the general practitioner. It is destined to become more of a necessity, as knowledge breaks down the barriers to its progress.

That that mysterious force, witnessed in the disintegration of certain metallic substances, could be put to practical use in medicine would have seemed little short of witchcraft to our ancestors. Now, we accept it as we do the subtle power that calls up the grass blade, or unfolds the leaf bud.

The value of this therapeutic agent dawned upon the medical world so suddenly that it was almost impossible, at first, to cope with its underlying principles. A new heaven was revealed, so bewildering in its glory of star upon star, that the gazer became absorbed with the *outward phenomena*, and forgot to trace the path of the power that made all this radiance possible.

We have two classes of electro-therapeutists: the empirical and the rational. The empirical electro-therapeutists are often found among our most intelligent and successful practitioners, and for two reasons:

First, the subject of electricity was not brought before the students in the colleges from which they graduated; and since graduation, they have had no time to thoroughly investigate the subject.

Second, the actual use of electricity is forced upon them in some such way as this: A chronic patient, tiring of long years of invalidism, and hoping that some force in the world, as yet untried, may effect a speedy cure, insists upon the use of electricity, and quotes to the physician various wonderful results that have grown from it in other cases.

The physician, eager for success, purchases a battery—usually a faradic, because it is cheaper, and because it makes a better impression upon the patient, on account of distinct sensation. Electro-physics is new and strange to this novice. From his reference books, he gains a hard and fast idea of the positive and negative terms. He cannot seem to realize that they are merely relative; his mind is a blank regarding the units of electricity. Electro-physiology is to him a sealed book, it has not been in the curriculum of his research, so he either partially succeeds, or is stranded upon some author's statement, that a certain current, under a certain condition, will produce certain results. Such partial equipment must condemn itself to the thinking mind of the conscientious, progressive physician.

The rational electro-therapeutist has abundant resources. If he has an obdurate battery, he can, because of his training in physics, repair and substitute for himself in an emergency; and because of his knowledge in electro-physiology, he can apply this as he could other remedies, correctly; or if it is not a complete success, from the rich treasury of his growing knowledge, new thoughts and discoveries will emanate, to swell the grand triumphs of this wonderful age of discovery. The boys and girls of our day are instructed in the elements of electro-physics, and understand the mechanism of the battery. Can we afford to be less intelligent? Can we run any risk of lowering our standard?

Electro-physiology is a subject of vast importance. As well might a surgeon attempt to amputate a limb, or an oculist to remove a cataract from the eye, without a knowledge of its anatomy, as for an electro-therapeutist to dispense disease and relieve pain by electricity, without understanding its elementary principles as well as can be known at the present day. There is much to study in electro-physiology. The action of certain currents on organs of digestion, nerve and blood supply, respiration, etc. Each demands its special research and experiment. It is like studying anatomy the second time.

We believe in this remedy—wide sweeping in its possibilities, and destined to be nobly grand and overpowering in its results. Its domain is in our midst, but waiting for new discoveries, that disease may be thwarted before it is established, and dispersed from our land.

We believe that this subtle energy is awaiting developments, more from the medical fraternity than from any other profession. It has a wider scope than any twenty of our well-known drugs. The world outside our profession is watching us. An eminent physicist of Boston wrote me lately that he would like to hear a paper, summing up the evidence that various electric treatments *did* do something, "with the imagination and similar effects deducted," without the subject knowing what is hoped. For example, what will a static machine do to the system; a Leyden jar discharged through a line; a weak continuous current, a strong continuous current, a weak alternating current, a strong alternating current? What is the effect produced at a distance from the electrode—say a foot or more? and so on.

Another asked, "What relation does the amount of current bear to the area of the electrode?"

When we graduate from the medical school, we are expected to understand the effect and dynamic power of drugs. How necessary it is for us to understand all that is possible of this most powerful and wide-sweeping of remedies! To be a good workman in any calling demands the knowledge and intelligent use of many tools.

It is our duty as physicians to use our influence with the different medical colleges, that they may establish a thorough course in electro-physics, electro-physiology, and electro-therapeutics, and that it should cover a space of at least two years along with the other studies.

Electro-physics should give the practical points regarding batteries, *i. e.*, the mechanism of them, methods of testing strength of currents, explaining the static, constant, and faradic. There is no easier way to understand this than to be able to construct a battery, if ever so rude.

Electro-physiology embraces a knowledge of the effect of these same currents on living animal and human tissues, in normal and abnormal states, after a thorough review of anatomy and experimental clinical work, and the effect of different currents in certain diseases, and the amount of electric energy required. It is true that Nature works with this mysterious force, the same as she does with drugs.

But we claim, in our use of electricity, a sense of nearness to, of working with, the divine energy, that nothing else brings so potently.

So we would plead for *knowledge*, that the full sun shall arise and scatter the fogs of ignorance and half-knowledge, that our faces may be set toward the light, and the world know us indeed as " Sons of the Morning."

Discussion.

DR. W. H. KING : I would like to say a word with regard to the letters which Dr. Gary received from the eminent physicist. I have received similar letters and I have no doubt others have. It is very well for a physicist, who simply deals with known quantities and has mathematical laws governing them to figure out just what has been done and what can be done; but we have a still greater subject than the physicist with his known quantities: we have not only the known quantities from the physicist's side but we have the unknown quantities from the physiological side: and to say that we are unscientific, that we are far behind in electro-therapeutics what is accomplished by the electrical engineer, because we cannot figure out to a nicety, to a mathematical exactness, just what will be done, is not particularly fair; they should judge us, I think, more rightly from the physician's standpoint. I would like to know what physician would get up and say just what action a dose of creosote has upon the lungs, or what action a dose of mercury has upon a specific condition. It is from that point of view we should be judged, I think. It is not fair to judge us from the physicist's point of view, because no one can tell what we are dealing with, we are simply groping, so far as the physicist is concerned, in the dark; but, on the other hand, we are not groping in the dark, because we have a guide to go by in our clinical experience.

MR. OSTERBERG: To give you a weapon in your hand, I can state a very similar case where an electrical engineer would be baffled. In Dr. Gary's paper I have not heard the word *resistance.* The word *resistance* is very important. The human body consists of so many arteries and tissues; so far as electrical resistance is concerned, it would be simply a matter of figuring out each particle and its resistance and then to compute the combined resistance of the whole body. Now, if you consider the net-work of wires under the streets of New York, representing a value of several millions of dollars; wires distributed from the central stations where there are perfect plans of all those wires: then the man in the central station is in about the same relation to all those wires as the doctor is when he applies electricity to the outside of the body; he is at the terminal, but he cannot get at the various ends, and there is no electrical engineer that can determine the total resistance of all those various parts of the system; he is just as badly off as the doctor so far as that is concerned; he can figure out what resistance a single feeder, each single wire has, but we have no means of figuring out the entire resistance of the entire system of the city. So, you see, Dr. King, we have some things we cannot solve ourselves.

DR. KING: I am glad to hear that from an electrical engineer.

THE DEVELOPMENT OF THE HIGHER VOCAL REGISTER BY ELECTRICITY.*

BY WILLIAM HARVEY KING, M. D.

So complicated and at the same time so perfect is the larnyx as a musical box, that in order to obtain a perfect understanding of its numerous actions it is necessary to make some comparison with other and less complicated musical instruments.

It is a well-known law of physics that sound is due to vibrating movements of air, and it matters not how these vibrations are produced provided they are sufficiently rapid.

If we cause a tuning fork to vibrate by forcibly drawing it across a table, we find it has a definite sound known to musicians as pitch. Gradually the sound dies away, but the same note or pitch remains until the last sound is heard. If we analyze these vibrations we find they may be divided. for the purpose of study, into two parts, one the rate of vibrations or number of vibrations per unit of time, say in one second, the other the amplitude of vibrations or the distance to and fro that each vibration travels. If we study these vibrations experimentally we find that the volume of sound or its loudness depends upon the amplitude of the vibrations, and the reason why the sound dies away is that the amplitude of the vibration grows less and less and finally ceases altogether. On the other hand the pitch or note of the sound depends entirely upon the rate of vibration, and this rate does not change until the fork comes to perfect rest. This explains why the note never changes in a tuning fork, no matter what may be its variation in volume of sound.

Turning from a tuning fork to a stringed instrument, say a monochord, which may be easily constructed by stretch-ing a fiddle string or fine wire across cleats fastened at each end of a wooden box, we find that drawing a rosined bow across the string or wire causes it to vibrate, and a certain musical note is heard. If we have an arrangement for tightening the string of our monochord and again draw the bow across it, the note sounded is of a higher pitch than before. We therefore learn that the height of pitch depends greatly upon the tension of the cord, or to be more exact "the rapidity of vibration is proportional to the square root of the tension."

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* Read before the National Society of Electro-Therapeutists, September, 1896.

If now we clasp the center of the string or wire of our monochord between the forefinger and thumb of the left hand, and again draw our bow across the center of one of the halves, we get a higher pitch than before; in fact, we get what is known to musicians as an octave of the former one, which is simply one octave above. If we measure the rate of vibrations of our string before it was clasped with the thumb and finger and again after, which can be easily done by comparison with a siren, we find the higher octave is produced by just twice the number of vibrations of the lower one. If the string is divided into four sections by properly dampening it and the bow drawn across the center of one of the sections, it will give an octave higher than when it is divided into two sections, as the vibrations will be twice as rapid. Cut the string each time and shorten it to one-half or one-quarter the length, the same result will be produced. We learn from this that "the length of the string is inversely proportional to the rapidity of the vibration," or the height of the note sounded.

If now we replace the string or wire of our monochord with a heavier one, and have an arrangement whereby we produce the same tension as in the first, and draw our bow across it as we did in the first experiment, we get a very much lower note, which, if measured, its rate of vibrations is found to be less, thus accounting for the lower pitch. If instead of replacing the first wire with a heavier one we replace it with a thinner one, we will get a higher note, as the rate of vibrations will be greater. We therefore learn that the rate of vibrations or the height of pitch, which means the same, is dependent upon the density of the vibrating wire or string, or to be more exact again, " the rapidity of vibrations is inversely proportional to the square root of the weight of the string."

What is true of the string of a monochord is true of the vocal chords. The shorter the chords, the less their density, and the greater their tension, the greater the rate of vibration and consequently a higher pitch. If we study closely the operation of the vocal chords under the light of these truths, we arrive at an explanation of everyday observations. One of these is the difference between a man's and a woman's voice. The vocal chords of a man are slightly longer than those of a woman and their density greater. Thus a woman's voice is an octave above a man's in conversational tone, and two or more octaves when the higher notes are produced. The tension, however, is the all important part in producing high notes with the voice.

If we analyze the vibrations of the string of a musical instrument we find it is composed of two distinct sets of vibrations, those of the string as a whole, unless it is dampened, and those of certain sections of the string which vibrate independently; and as we have seen, the vibrations were more rapid when the string vibrates in sections, so we find here that the independent sections vibrate more rapidly than the string as a whole. The result is a difference in the notes produced by the two sets of vibrations. The note produced by the vibrations of the string as a whole is known as the fundamental tone, while the higher ones produced by vibrations of sections are known as the overtones. It is these overtones which give the distinctive sounds to different musical instruments, and were it not for them the human ear would be incapable of distinguishing a piano from a violin or other musical instrument.

If a vibrating reed be placed at the opening of an organ pipe and a blast of wind forced through it so as to cause the reed to vibrate a musical sound is heard. This sound, however, does not emanate directly from the air set in motion by the tongue of the reed, but by the vibration of the column of air in the pipe, which in turn is set in motion by the vibration of the reed, and like the stringed instruments has two sets of vibrations, which produce a fundamental note and overtones. Without describing the difference which exists between open and closed pipes, we may say that like the stringed instruments the pitch varies with the length of the pipe, the shorter the pipe the higher the pitch. If the blast of air is driven with a gentle force through the reed the fundamental tone predominates; if the blast is increased by a certain addition of force there will be a momentary fluttering sound owing to the lack of rhythm. Soon, however, the vibrations will accustom themselves to symmetry of motion, and the first overtone will be distinctly heard. It is possible to again increase the force of air until the second or third overtone is heard, when they completely mask the fundamental tone.

If we study this increased rate of vibrations which produces the overtone, we find they are the result of the short distance the vibrations travel owing to the formation of notes at intervals along the vibrating path. If we again make an application of the lesson learned through this rude instrument to the most perfect one, the human voice, we learn some very interesting lessons. We find the vibrations produced by the vocal chords are reinforced by vibrations of a sounding board located in the mouth and upper air passages, which in turn produce vibrations that are conveyed to the human ear. But we should not put too much stress upon this resonance of the mouth and upper pharynx in producing high notes. The singer has the power by certain muscular movements to so change the length of vibrations produced by the vocal chords, by changing the shape and length of the cavity of the mouth, that he can by this means change the pitch of the fundamental tones. He can adjust and proportion the length of the vibration, but his power in this direction is limited, and in order to produce the higher overtones, or in other words the higher notes, there must be an increase in the rate of vibrations of the vocal chords and by this increase form certain notes and thus shorten the distance and increase the rate of vibrations. We therefore come upon the solid fact that in producing the higher notes we must depend upon the rapidity of the vibrations of the vocal chords.

The next question which demands our attention is by what means can the vocal chords be made to vibrate rapidly. This any student in physiology can answer, but it will bear a limited review here. In the first place, there must be a sufficient chest capacity to produce the necessary volume and blast of air through the glottis. Second, we must obtain the full force of this blast upon the vibrating chords. It is, therefore, necessary to close the glottis by bringing the vocal chords together, or nearly so. By this means no air escapes which is not utilized in producing the vibrations. Such would not be the case if an open space were left allowing a free column of air to escape.

As we have already seen, certain intensities of all vibrating chords produce a certain rate of vibration, therefore, to produce a high rate of vibration, we must have a high tension. One thing should always be taken into consideration, that the length, or, more properly, the density of the vocal chords must always classify the singer. One woman with a particularly dense vocal chord will have an alto voice, another with less dense chord will have a soprano voice. The same is true of men, distinguishing the bass and the tenor. We may have extremes in the density of the vocal chords, those carrying the voice to a high pitch which is disagreeable to the human ear, or *vice versa*. The high pitched squeaky voice is due, Helmholtz says, to a retraction of the membrane which in a normal state loads the vocal chord but here leaving only the thin fibro-ligamentary band exposed.

As all the different functions of the vocal chords are controlled by muscles, it is evident that we must rely on their strength, quickness of reaction, and power of endurance to give both quality and power to the voice. The crico-thyroid muscles by their contraction, force the anterior attachment of the vocal chords downward and forward and thus tense and elongate them. The arytenoideus, crico-arytenoidei lateralis close them together. The first set of muscles, or crico-thyroid, are supplied by the superior laryngeal, while the two latter groups are supplied by the inferior or recurrent laryngeal nerve.

The purpose of this paper is to illustrate the action of the electrical current through these two nerves in developing the muscles supplied by them, for it must be evident by what has already been given that only by a high state of development of these muscles can high notes be produced. In looking over the literature on this subject I have been confronted at nearly every turn with the opinion of the late Sir Morell Mackenzie, that electricity applied externally acts as a local tonic only and may be useful in allaying irritation, etc., but it is of no use in developing muscles. In order to accomplish this it must be given internally, as one author quoting this opinion says, so as to pass through the muscles. With all due regard to this high authority, I am of just the opposite opinion, and believe that the only way to attain any great degree of development by electricity is by its external application. The reason why Dr. Mackenzie did not have success with the external application was due to a faulty understanding of the use of electricity in muscular development. I wish to call your attention to the articles and discussions on muscular development which have been before the last two meetings of this Society, and how it was shown that the interrupted galvanic current applied to the motor points far surpasses the faradic current or the continuous galvanic current; and also how the greater efficiency of the interrupted galvanic current was increased in cases of partial paralysis or functional weakness.

In order to apply the interrupted galvanic current to these muscles we must first have motor points. It is impossible to find these points inside the larynx, and even if it were the galvanic current could not be given to them with impunity. We must therefore look for them on the outer surface. After carefully studying the anatomy and experimenting with electrodes of different sizes and shapes, I have succeeded in locating these points. The external laryngeal, a branch of the superior laryngeal, supplies the crico-thyroid muscle. This branch, unlike the internal, does not penetrate the thyro-hyoid membrane, but runs down the outer and posterior edge of the thyroid cartilage to a point midway between its extremities, where it divides; one part supplying the thyroid body, the other the crico-thyroid muscle. The motor point of this nerve is just at its division and is easily reached by placing the electrode along the posterior border of the thyroid cartilage, about an eighth of an inch above the line drawn directly backward from the *pomum adami*. The inferior laryngeal nerve which supplies the arytenoideus and crico-arytenoidei lateralis passes under the lower border of the inferior constrictor muscle just in front of the carotid, and into the larynx at the point of articulation of the interior cornu of the thyroid-cartilage with the crycoid. It is just as it dips under the inferior constrictor muscle that it is most easily reached. The operator should first locate the point by carrying his finger back along the side of the cricoid cartilage until he reaches the point of articulation with the inferior cornu of the thyroid cartilage. Just back of this point the distinct beats of the carotid artery will be felt. The electrode should firmly pressed between these two points and the nerve will at once respond. The small sized Erb electrode can be used for this purpose, but one made of the same diameter but more oval in shape is better.

The question arises, To what condition is this treatment applicable? As the power of electricity in the development of weakened muscles is so well known, naturally the thoughts first go to those diseases where such weakness is manifest. It is well known that there is often a condition present where the muscles are of unequal strength on the different sides of the larynx. The result is that the vocal chords are put in unequal tension with a different rate of vibration and necessarily a different pitch. These different sets of vibrations collide with each other in the resonance cavity of the mouth and upper pharynx and produce discordant tones. In these cases the training of the voice by different exercises will not avail, for the well-known laws of muscular development that in physical exercise a muscle develops just in proportion to its power to absorb the increased nutrition which the exercise produces, would operate to make the condition worse instead of better, for the stronger a muscle is the more nutrition it will take on, and in these cases it is impossible to exercise the weaker ones without exercising the stronger ones. The fact that this treatment has to be given to each side separately makes it particularly applicable for this condition. The muscles of the larynx may be constitutionally weak. It has long been a recognized fact that a strong constitution does not necessarily imply that all of the individual functions partake of the same vigor. A man of a strong general constitution may have weak eyes or a weak throat, in other words, one may have a local neurasthenia, as pointed out in Dr. Beard's original articles on the subject of neurasthenia. One might say that here is a case for physical development. The simple exercise of the muscles such as are given by professional cultivators of the voice are all that is required. Now one who has treated neurasthenia knows that physical exercise is good up to a certain degree, but when you undertake to go beyond that point all exercise is injurious and if persisted in there will be a collapse. Exactly the same conditions prevail here and are the cause of so many voices breaking down under training. Many a time has the efficiency of electricity in these conditions been proved. Without going into a discussion of how it acts, as that subject has been so thoroughly discussed at former meetings of this Society, I might say that there are two forces, first, the increase of the nutrition by the active exercise of the muscles, which it should be remembered is involuntary so far as the person is concerned and does not produce any corresponding strain upon the muscles. This is proved by the fact that after a long series of exercises of a muscle by this method it does not feel fatigued and is capable of greater exercises than before the treatment, while if the same number of exercises were voluntarily made the muscles would be exhausted. The other force is what has been described by Remak and enlarged on by Erb as the catalytic action, and which is so well known that it need only be mentioned here. These two forces acting together are capable of developing muscles to a very high degree, overcoming the neurasthenic tendency, and placing it at the same time in a condition to be trained by physical exercise up to the highest degree.

The same principle applies to all the various forms of muscular weakness that these muscles are subject to. One condition to which it is particularly applicable is atrophy of the muscles from overuse which occurs in professional singers. The training of these muscles given by professional music teachers is often of a faulty nature. It instructs the pupil how to spasmodically contract the muscles of the larynx instead of developing the real muscular tissue. Persons so trained will be able to force a few high notes, but the muscles soon tire and the voice breaks, they lose confidence in themselves and give up singing. Here again the use of electricity is found to be most efficacious in developing the muscles up to the required endurance.

There is one other condition to which I wish to call your attention. If I understand Helmholtz aright, he does not believe that the cartilaginous tissue of the vocal chord is capable of congestion. That hoarseness is not due to this cause, but to a collection of mucus over the vocal chords, thus loading them and keeping them separated at the same time, or to a congestion of the mucous membrane which partially surrounds the vocal chords and at all times loads them to a greater or less degree, but its power in this direction is greatly increased when its own density is made greater by the congestion. Of course if the congestion is an active one as with an acute laryngitis electricity is not indicated, but there are other cases where this membrane becomes passively congested as the result of overuse, chronic catarrh, and various abuses. Now one of the features of the catalytic action of Remak is a decrease of the passive congestion with a corresponding increase in the arterial circulation. We therefore by this treatment might not only expect a decrease of the passive congestion but a toning up of the arterioles and a general increase in nutrition to the parts.

Many are the conditions where the general nutritive effects of this treatment might be employed, but here I bring this long paper to a close with the wish that physicians, scientists, and music teachers present will all discuss the subject freely.

Discussion.

Dr. William R. King of Washington, D. C.: In looking over the programme I have selected this paper as being of special interest to myself, inasmuch as I have been to a certain degree experimenting in the same field during the past year. I must say I am amply repaid for my journey, and I fully agree with Dr. King in his conclusions with reference to the value of electricity in this class of cases. The interrupted current, as suggested by Dr. King, would be very impracticable applied internally. My attention was first attracted to the possible development to be expected in the muscles of the vocal organs through a correspondence I had with a very prominent vocal teacher in Washington. He told me of the successful issue of some massage applied by a scientific masseur to one or two of his pupils who had a great deal of difficulty with the upper register of their voices, that is, a difficulty of continuing a clear tone. They could make a few clear tones, a few high notes clearly, but they would very shortly play out. The improvement obtained was not exceptionally marked, but it was something, and led me to think of the possibilities without hearing of Dr. King's experiments. In a very crude manner I experimented on the few cases I had, and notably upon two school teachers who had a great deal of difficulty with their voices tiring and becoming husky in a short time. They were referred to me as possibly being cases for that treatment, and possibly laryngitis. On examination, I found the mucous membranes of the larynx absolutely normal, and after careful examination and thought I concluded that it was undoubtedly due to a condition of atony perhaps of the contractile muscles of the larynx and vocal cords. I used the faradic current for a short time, and used the interrupted galvanic battery. By applying electricity around the location described by the superior angle of the thyroid cartilage, I obtained decidedly beneficial results in one case, a teacher teaching one of the intermediate grades. She was able to continue all last winter with considerable comfort. In the case of professional vocalists who have rehearsals in conjunction with their professional work and have over-used, overtaxed the muscles, in several instances I have had good results. I have not been experimenting long enough to come to any definite determination, but I have been very much encouraged by the few crude experiments I have made. I should like to hear the matter discussed by some who perhaps have had more experience than I have.

Dr. J. B. Garrison : I have had some experience during the past year and a half, and with very excellent results.

In a paper which I sent to the society last year I illustrated it by several cases which I had treated, also by some cases which Dr. King had treated previous to that time.

During the past year I have carried on the testing of it in my private practice and in the Dispensary at Twenty-third Street which have resulted in great benefit. As a voice tonic it certainly surpasses anything I ever tried.

Chairman : Dr. Palmer, have you had any experience ?

Dr. Palmer : I have not experimented in that direction.

Dr. W. R. King of Washington, D. C.: I think it will prove a special aid or adjuvant to the vocal trainer, the teacher who undertakes the training of the vocal organs and finds this physical defect, if he can be brought to understand what that physical defect is, and by referring them to the proper person to apply this electricity, this voice tonic, as Dr. Garrison has so aptly termed it. It will put him in line for developing voices that he otherwise would in many cases make an utter failure of. I do not presume there are any vocal teachers present, but I think it is something that will come directly in their line of work and study.

Dr. W. H. King of New York : I was trying to name the conditions under which it is applicable. I am a great believer in the voice exercises used by music teachers ; I have known most wonderful results to be obtained from them. My attention was first called to this by one of the best music teachers in the city. A young lady, one of his pupils, could not sing a note, which was found to be due to the fact that the muscles of one vocal chord were partially paralyzed ; the two cords were not drawn to the same tension, and she was unable to produce a note. Being the sister of one of our well-known physicians, he brought her to me to see if I could not help her, which I did, and from that time on I have worked in a number of cases.

Mr. Wolcott : There have been some phenomenal voices, of great compass, is that due to more perfect muscular development ?

Dr. W. H. King of New York : It is due to several causes : to the texture of the chord; to the way it is located in the mucous membrane : a mucous membrane sometimes covers over a vocal cord to such an extent that it has a very small range ; the third and principal thing is due to the muscular development, which that voice has by putting the vocal cords on strain. The resonance of the upper air passages also has much to do with it.

A FEW CASES TREATED BY CATAPHORESIS.

BY EMILY A. BRUCE, M. D., BOSTON.

Whenever I extol the virtues of cataphoresis I feel like making an apology to my tried and faithful friend the constant current, for venturing to propose an ally for it, since it alone has proved all-sufficient in so many difficult and discouraging cases.

Neuralgia yields to it so constantly and promptly that I have rarely felt the need of using any other agent except the remedy indicated in the individual case. A most intractable case of prosopalgia of thirteen years' standing was perfectly and permanently cured by applications of the constant current twice weekly for five months, and a case of intercostal neuralgia that had rendered the patient's life almost unbearable for ten years yielded completely after ten treatments had been given. An undoubted incipient felon upon the right index finger of a lady who had already had two felons on the same finger, and therefore was not in doubt as to the symptoms, was completely aborted by two treatments of the constant current, without aid from any medicament.

I could cite many other cases scarcely less satisfactory, but merely mention these as a grateful acknowledgment of the merits of electricity alone before proceeding to report cases in which it has shared the honors with another agent.

In view of the exceeding value of the results obtained by electrical cataphoresis in many widely differing pathological conditions, the meagerness of our literature upon the subject is not a little surprising; indeed, I have found no reference whatever to the treatment of certain classes of cases which in my hands have been most favorably influenced by it.

Neuralgia, rheumatism, gout, exophthalmic goiter, glandular enlargements, the lesions of secondary and tertiary syphilis, and the production of local anæsthesia for small surgical operations are the principal conditions for which it has been recommended.

I have used the method with fair success in most of these conditions; but in the treatment of disorders of quite a different character I have found my greatest gratification. The discovery of its power to abort abscesses, carbuncles, felons, and other acute local inflammations has enhanced its value immeasurably, and given it a high place among the really curative agencies. In the treatment of such cases as these I have had constant success.

I must plead guilty of not demanding of myself exact dosage in applying this method; the same shape and size of electrode rarely being suited to different cases, except those of hypertrichosis, and here I have better means at my command to allay the slight pain incident to the operation.

The following typical cases have been selected from a considerable number treated by cataphoresis.

CASE I. *Vulvo-vaginal abscess.*—Mrs. H. consulted me for menorrhagia in January, 1894, and while under treatment for this disorder, one day called my attention to a painful induration of the left vulvo-vaginal gland, and informed me that during the last few years she had many times suffered from abscesses in the same place. Suppuration had invariably followed the development of the indurated mass.

Having already had some favorable experiences in arresting the development of incipient abscesses, I hoped to do as much for this one. Selecting a small olive-tipped electrode, I covered it with absorbent cotton saturated with a mixture of equal parts of tincture of iodine and fluid extract of belladonna, and attached it to the positive rheophore. The point of the electrode was pressed firmly to the opening of the duct and a current of 20 milliamperes gradually turned on and allowed to pass for five minutes; then as gradually reduced to zero, and the electrode removed. The negative pole was placed under the nates.

The treatment was not needed a second time. The sensitiveness and tumefaction began to subside almost immediately, and at the next visit three days later there was scarcely a vestige of it left.

These incipient abscesses, as well as those in other parts of the body, rarely fail to yield promptly to this treatment. In this case it seemed to remove the tendency, for she has never had a recurrence of the trouble since then.

CASE II. *Phlegmonous Tonsilitis.*—On the 7th of July last, Miss G., who had in the past suffered from many attacks of quinsy, which under " regular treatment " invariably terminated in suppuration, and detained her from business for five or six weeks, came to my office complaining of the too well known symptoms.

Externally the right side of the neck was greatly tumefied, cyanotic, and sensitive; internally the dark bluish right tonsil nearly filled the cavity of the throat, rendering the opening of the mouth difficult and painful. There was a heavy aching from the nape to the larynx. I prescribed merc., a gargle, and cold packing of the throat.

Next morning the patient came feeling and seeming much worse. Temperature 102°, the parts more swollen and more painful, the distress extending into the right side of the head and the corresponding shoulder and arm, deglutition and speech difficult. I directed her to go home and go to bed, telling her I feared an abscess was inevitable. She replied, " It is entirely impossible for me to be sick now. My employer is in Europe and has left the management of three stores in my care. No one can do my work for a day. You must get me out of this. I believe you can." The situation was indeed desperate. What was to be done? "Try the current," flashed like an inspiration through my mind. A pliable electrode was selected, lined with a layer of absorbent cotton previously saturated with a mixture in equal parts of tincture of iodine and fluid extract of belladonna. This was fitted snugly to the swollen side of the neck and attached to the positive rheophore. The negative electrode was applied to the opposite side of the neck. The current was gradually raised to 20 milliamperes and allowed to pass for eight minutes, then reduced, the electrodes removed, and the neck bathed in alcohol. The remedy was continued.

Next day, July 9, the patient came delighted, better in every way. The treatment was repeated and baryta carb. substituted for merc.

On the 10th symptoms still more ameliorated, the fever gone. No electricity. Remedy continued. Three days later the throat was nearly normal, but a part of the external swelling still lingered and she received 15 milliamperes for five minutes without any medicament. Patient discharged. She had attended to her duties throughout the attack, although suffering greatly three days of the time.

CASE III. *Diffuse Lipoma of the Hip.*—For more than a year Miss W. had noticed a considerable enlargement of the left hip, which had increased steadily until the date of my examination of the patient, February 20, 1892. At that time a very apparent deformity existed, caused by the presence of a diffuse lipoma, the most prominent part of which covered the middle portion of the crest of the left ileum. Although I had not seen any recommendation of cataphoresis for such a condition, it seemed to me a promising remedy, and would if successful avert the necessity of a surgical operation, which must be quite a serious one, in view of the large extent of surface covered by the tumor. The treatment was commenced at once. A pliable copper electrode eight inches square was chosen, lined with absorbent cotton saturated with dilute liquor potassæ, and fitted closely to the tumor. The positive pole was connected with the electrode, and the negative electrode, a large sponge, was placed upon the opposite hip. A current of 25 milliamperes was used and continued ten minutes.

On the 23d the treatment was repeated, tincture of iodine being substituted for the liquor potassæ. The same treatment was given on March 4, 11, and 22, alternating the remedies, and after the last treatment scarcely a vestige of the tumor remained. The diminution was apparent after the second application, and the tumor continued to diminish constantly until its complete disappearance.

I had occasion to examine the patient four months later and found the hip quite normal in shape and size. It is now four years since the removal of the tumor and there has been no recurrence of it.

I hope later to be able to report the cure by cataphoresis of a case of effusion about the knee joint, which for twelve years has resisted every effort at amelioration even.

Discussion.

Dr. W. H. King : Before the discussion on this paper begins I would like to have the Secretary read Dr. Gardner's question on cataphoresis, so that they may both be discussed at the same time.

Secretary : The question for discussion is, "Why is iodine used at the positive pole?"

Chairman : The paper of Dr. Bruce and the question of Dr. Gardner are now open for discussion. I should like to hear from Mr. Osterberg.

Dr. F. A. Gardner : Why should not iodine be used at the negative pole rather than the positive? I should think it should be used at the negative in preference to the positive.

Mr. Osterberg : It depends upon whether iodine is electro-positive or electro-negative with respect to the electrodes. If it acts like hydrogen, it would be carried from the negative to the positive pole; otherwise it will go from the positive to the negative.

Dr. W. H. King : Is it an electro-negative element?

Mr. Osterberg : I wish I had a book on physics with me; I do not know all the elements by heart. It is practically of no use in electrical engineering work. You can, however, easily experiment with it by simply sending an electric current through a bath containing iodine in solution.

Dr. F. A. Gardner : For the past three or four years I have used extensively iodide of potassium for all manner of bruises, sprains, etc.; and when I used the positive pole with a saturated solution the iodine was invariably left upon the cotton. If I used the negative pole it was not, and I thought I got better results from the negative than from the positive. It was of course split up right there, but with the negative pole it was carried into the body, and the iodine would pass over to the positive pole. I test my batteries when I am uncertain whether I have the positive pole or not; of course I know the positive pole by the iodine which collects, and that led me to believe that that was the wrong pole.

DR. F. M. FRAZER: I think it goes from the negative. We have a glass tube fitted into three compartments by two plaster-of-paris blocks: in one is a weak solution of iodine, in the others a solution of starch; the electrodes are made of platinum. When the current was run through, the positive being in the iodine, the iodine evaporated, and there was nothing there. When the negative was in the iodine, the iodine was driven through the first plug into the middle compartment, coloring that blue, and through the second plaster plug into the third compartment. The whole thing was blued, and then it gradually cleared up beginning at the negative end and the iodine all disappeared, so it was driven by the negative from one compartment through two plaster plugs, coloring the starch all the way to the positive, where it disappeared.

DR. W. H. KING: As Dr. Frazer has stated, we could see the iodine actually traveling through the starch solution. We made another experiment: A large U tube with a very large plug of plaster—I think it must have been an inch thick—in the bottom of the U tube was used. We carried iodide of potash down through the plug and up on the positive side, but we got no discoloration until the iodide was carried up and immediately surrounding the positive pole: so that when the iodide of potash is placed on the negative pole iodine is not set free; if it is taken from the potash, it combines with some other element, and does not appear as free iodine until it reaches the positive pole. If you use the iodide of potash on the negative pole, you must have the positive pole placed where you wish to get the effect of the iodine, or you will not get it.

I believe the reason we have good results from using iodine upon the positive pole has not been given, that it is not due to the cataphoretic action of the iodine at all, but is due to the fact that from the action upon the skin (for instance, in treating goiter), it has so reduced the resistance of the skin, that the current, instead of being spent upon the skin, is carried through and spends its action upon the inner tissues which have, under these circumstances, a little more resistance than the skin itself.

Mr. Osterberg: Didn't the iodide on the positive pole color the tissues of the skin?

Dr. W. H. King: Yes, but it will color it any way.

Mr. Osterberg: Might it not be possible that you simply allowed the skin to absorb that iodine and produce the action in that way?

Dr. W. H. King: That is what I believe, that the skin does absorb it and it thus decreases the resistance of the skin.

Dr. F. A. Gardner: I found before I commenced to use the negative pole that if vaseline or olive oil was used upon the skin where you placed the positive pole and the iodine, it passes in more readily and you get better results.

Dr. Alice Condict, Orange, N. J.: Suppose you wanted to have the iodine act deeply where you have a deeply seated inflammation; what would you do to make the iodine have more effect?

Dr. W. H. King: I should certainly use it myself on the negative pole; and I believe on a cystic tumor where the iodine is carried in that way, it has much greater action than when it is injected in. It must be set free molecule by molecule, and each molecule exerts an action of its own, and in that way the action is greatly increased.

SOME FAILURES AND CURES IN THE TREATMENT OF ENDOMETRITIS BY GALVANISM.

BY F. A. GARDNER, M. D., WASHINGTON, D. C.

Most surgical gynecologists of to-day are much opposed to the use of electricity. Either this is because it is extending too deeply into their domain or they will not take the time and trouble to look carefully into the matter.

Of the treatment of endometritis by galvanism the "American Text-Book of Gynecology" reads as follows: "To-day in the critical light of modern research, and the generous distribution of knowledge, it exists, not because of true merit, but through the timidity of suffering womankind, who grasp at the hand offering any relief without an operation."

From my experience in the treatment of chronic endometritis "during several years past" with the Apostoli method and more recently with the method as taught by Gautier, I am convinced that a large percentage of uncomplicated cases of simple chronic endometritis can be cured by one or the other of these methods, providing the physician pays strict attention to antisepsis and applies the current according to the technique as advised by Apostoli and Gautier.

Apostoli uses a current varying from 75 to 250 milliamperes, and claims to cure the more severe cases. I seldom find a patient who can or will tolerate the high currents used by Apostoli; in most of my cases I use a current varying from 60 to 125 milliamperes. During the past two years I have used the Gautier method more frequently than the Apostoli, with a current from 30 to 59 milliamperes, using the copper electrode in preference to the zinc mainly because I am more accustomed to the copper; as for the difference in the results in the use of the copper and zinc, I can see but little. In cervical endometritis, I use the Gautier method entirely with a current of from 15 to 25 milliamperes.

In cases of corporeal endometritis when the hypertrophy has gone on to that stage where we have increased menses, intermenstrual bleedings, and a profuse leucorrhœa which is often purulent, if the positive platinum electrode is used and is followed each time by a bleeding lasting from three to ten days, I discontinue treatment and advise an operation, as most of these cases are found upon curetting to be of the fungoid variety and it is this class of cases we fail to cure. I do not believe that endometritis which has reached this stage can be cured by electricity. This conclusion I have drawn from the result of treatments which the following cases will show.

CASE I.—Patient aged thirty-six, married, two children, chronic corporeal endometritis of six years' standing—profuse and constant leucorrhœa, sometimes bloody, dysmenorrhea, and an almost unbearable backache. Commenced with positive platinum intra-uterine electrode, current 60 milliamperes for ten minutes, which was followed by a bleeding which lasted several days. The Gautier method was then used, copper intra-uterine; this increased the backache and bleeding; returned to the platinum, which was used five times, resulting in constant hemorrhage; I then advised an operation, and upon curetting the uterus was found full of fungosities.

CASE II.—Aged thirty, married, one child. Chronic corporeal endometritis of seven years' standing; profuse, acrid, bloody discharge almost constantly, with all the symptoms which usually attend such cases. Commenced with platinum intra-uterine electrode, current of 75 milliamperes for five minutes once in five days; after several applications, commenced to have pains all over body, discharge became fetid, had two or three chills each day, followed by rise in temperature, and in fact had all the symptoms of septicæmia. I advised curetting, which was done at once with almost immediate relief. The uterus was filled with fungosities.

CASE III.—Aged forty, married, two children, chronic corporeal endometritis, constant uterine pain; profuse, acrid, brownish leucorrhœa, fetid odor. Used positive intra-uterine electrode, current 50 milliamperes for five minutes; after each application a flow came on lasting from five to twelve days. The Gautier method was then used with the same result. I advised curetting, and the uterus was found full of fungosities.

CASE IV.—Aged forty, married, six children, uterus slightly retroverted, some adhesions, leucorrhœa from one period to the next and almost as much in quantity as ordinary menstrual flow. Commenced with positive intra-uterine electrode, current of 40 milliamperes; for five minutes after each treatment a bleeding came on, very profuse and prostrating, which lasted one week. Six applications were made with the same result; I advised curetting, and the same condition was found as in the preceding cases.

Those which I will now report represent the class of cases which I have found yielding most readily to this treatment.

A. Aged thirty, married, no children, chronic corporeal endometritis, constant leucorrhœa, dysmenorrhea, backache, etc. Used positive intra-uterine copper electrode, current of 40 milliamperes ten minutes, three treatments each month; at the end of the fourth month considered herself quite well.

B. Aged twenty-four, unmarried, chronic cervical endometritis. This is a case of several years' standing, she having been through the routine treatment for such cases from several physicians. A copper electrode $\frac{7}{16}$ inch in diameter was passed into cervix, positive pole, current of 15 milliamperes for ten minutes; twelve treatments were given in all, resulting in a cure.

C. Aged thirty-five, married, two children, cervical endometritis and chronic ovaritis. Commenced with positive copper electrode, $\frac{5}{16}$ inch in diameter, in cervix, separate pad over each ovary attached to the negative pole, current of 15 milliamperes for ten minutes, followed by the faradic current of tension, metallic ball in vagina for ten minutes. This was continued for five months and five applications each month, resulting in entire relief of the ovarian trouble and a gradual return of the cervix to a normal condition.

D. Aged thirty-six, married, two children, chronic corporeal endometritis, slight sanguineous and very acrid discharge, keeping the vagina and vulva in an inflamed condition. This she claimed to be the result of infection from her husband, who had a chronic discharge from an old stricture. Treatment, negative platinum intra-uterine electrode, current of 75 milliamperes for ten minutes, five applications each month; at the end of four months' treatment she considered herself cured.

E. Aged twenty-seven, married, two children, chronic corporeal endometritis. Commenced with platinum intrauterine electrode, current of 40 milliamperes for five minutes; in this case severe pains came on as soon as the current commenced to flow, which was quickly relieved by substituting faradic current of tension for a few minutes. This patient was treated for four months, five treatments per month, resulting in a cure.

F. Aged twenty-one, unmarried, constant backache, profuse leucorrhœa, dysmenorrhea, and retroversion; all her trouble dates from a fall from her horse, one year ago. Has always suffered from dysmenorrhea, but very much more since her accident. Commenced by applying negative platinum electrode to cervix, positive dispensing pole on the lumbar region, current of 6 to 8 milliamperes for four minutes; after five treatments were given in this manner, the electrode was passed to the fundus and a current of 20 milliamperes given for ten minutes; six treatments were given in this manner, then the intra-uterine current was made positive and the dispensing pole placed upon the abdomen, the uterus was raised to its normal position, and a current of 30 milliamperes used for ten minutes. This patient was treated for five months, five applications each month, and at the end of the fifth month the uterus was in normal position, leucorrhœa had ceased, and menstruation was painless, and has remained so.

Discussion.

Dr. W. H. King: I would like to ask Dr. Gardner a question—if he considers that the fungus form of endometritis is not a case for electrical treatment?

Dr. Gardner: I have not had any success with it. That is what I wanted to find out.

Dr. W. H. King: I have used all methods of treatment, but I have given up almost entirely the use of the Gautier method; it produces pain and produces far more discomfort, and I do not think it presents any particular advantages except from one point, and that is, in that treatment you use a very large electrode.

Gautier gave very distinct rules regarding this, that the electrodes must fill the cavity entirely, which we have followed in that particular line of treatment, while we have not in other lines of treatment. One reason why we have not is because we have always been obliged to use platinum electrodes. Now, as a matter of fact, if we had the different sizes of platinum electrodes that we have with the copper electrodes, it would cost us between five and six hundred dollars for our electrodes. Another reason is that we have not had it so distinctly impressed upon our minds that we must use a large electrode. I believe if we use with the positive pole a large electrode, just as large as we use in the copper electrode of the Gautier method, that we will obtain just as good results with less trouble, less discomfort, less pain, and far less liability to hemorrhage. This we can now do. There have been efforts in years past to cheapen our electrodes. One consisted in an iron bar which was treated with some chemical process (I forget what now), so that it did not corrode on the positive pole. It, however, was utterly useless and never could be conformed to the cavity of the uterus. Then the carbon electrodes of Apostoli; they were not antiseptic, there were cases of poisoning reported from them, and they fell into disuse. However, we have in the aluminum electrode one which entirely fills the bill. We have here a very cheap metal: it is not only cheap but it is flexible. By taking the very largest sized electrodes and heating them up to a very high degree and then allowing them to cool, they become so that we can bend them with our fingers, so that they will conform to any cavity of the uterus that we may wish to apply them to, and we also have so cheap a metal that we can get the finest gradations, therefore obtaining complete apposition between the electrode and the diseased surface; and just here is the secret of success in the treatment of bad cases. There is no intra-polar action here to speak of; I believe there is some, but it is chiefly an electrolytic action where the diseased surface is. Here we can produce as much electrolysis as we wish, and we can destroy as much diseased tissue as we wish just as well as we can scrape it off. There is always a diseased condition back of the fungi which produces them, and will, in time, reproduce the same condition. The idea is not only to remove the fungi but also destroy the diseased tissue underneath it, which is not removed by the ordinary scraping of the uterus. Here we have an agent that will do it. The first treatments in fungi of this kind will not be followed by immediate results, because the electrolytic action is entirely upon the fungi and not upon the diseased tissue underneath; but after they have been destroyed and had an opportunity of being thrown off, then you will begin to see results, and not until then.

There is another point in treating this condition which should be taken into consideration : I believe that many of the cases of inflammations of these parts which followed treatment have been due to lack of drainage. After treatment of this kind, if you do not have perfect drainage, if the internal os is not completely dilated, you are liable to have inflammations and septic conditions follow ; therefore, the first principle is to see that you have an opening for the drainage, and then go on and treat with as strong currents as you wish, being careful that you get the whole surface involved within the electrolytic action.

DR. ALICE CONDICT : I have been in the habit of treating endometritis with the positive electrode for some time ; I never used higher than 30 milliamperes, and when I have a case where I put in the positive electrode, in treating for endometritis, I know the minute there begin to be bubbles coming out—sometimes bloody, sometimes clear mucus—that I have got a great deal of trouble ; but if there is very little of the discharge coming out, I know I am soon going to cure that case.

May not the reason that Dr. Gardner has had such unhappy results be that he has used such high currents, that he has made such large destruction of the fungi that he has actually laid bare an immense amount of surface. If you had worked a little slower, used a little lower current, and let your healing go on underneath, wouldn't it have been better ?

I have never had any septic cases at all. There have been two or three cases that have drifted away from me before they were cured, which, I heard afterward, turned out badly ; but those who have stayed by me I have not failed to cure.

I would like very much to hear what you think about the high current, whether it destroys too rapidly, in respect to hemorrhage.

DR. W. H. KING : I do not believe, unless you use a very strong current, you can set up an inflammation simply by the electrical action inside of the uterus. The uterus is very tolerant—I believe the most tolerant organ of the whole body to the electric current, and, unless you should use a very strong current (I have used in cases of hemorrhagic fibroids some years ago as high as 700 or 800 milliamperes for half an hour inside of the uterus, and I have never yet seen the least damage from them), it is possible to get septic conditions in this way, but I believe it is due to the fact that there is not drainage enough for the material, and it is dammed up, as it were, and thus absorbed.

DR. CONDICT : Where does the hemorrhage come from ?

DR. KING : It comes from removing the electrode too quickly, that is, the electrode on the positive pole, which will invariably fasten itself to the tissues, no matter what method you use—not that there is any action on the electrode that fastens it there, but it will fasten itself at that point. Perhaps it is due to the dryness of the tissue around the positive eschar; if you do not loosen that electrode gently you are liable to remove or tear loose some little point which will open up a hemorrhagic spot. In using the copper electrode—if you do not reverse the current so as to loosen the electrode—there is the greatest danger of getting a great amount of hemorrhage. When I use the largest electrode I always loosen it just the same as the copper electrode, and when the current is reversed always try to gently loosen it.

DR. GARDNER: May I ask Dr. King if he cured those cases and what success he had with fungus endometritis.

DR. KING: I believe I had just as good success as in any kind, except a form in the early stage of cervical endometritis. I believe that the catephoric treatment will do more than any other treatment for that condition.

CHAIRMAN: Dr. Bessie P. Haynes submits the following: "Would you treat a case of hystero-epilepsy with electricity, cause unknown?" We would like a discussion of this subject.

DR. W. H. KING: I have a history of the case, and whether the diagnosis be correct or not is immaterial. If it is hystero-epilepsy, we know something about the pathological condition: we know that it is a case of hysteria assuming an epileptic form; we know that it bears the same relation that typhoid malaria does to typhoid; it is malarial fever that assumes the typhoid form. Now, if it is hysteria, I do not see why it should not be treated by electricity the same as any other form of hysteria. I am unable to conceive why we should throw out any special forms of hysteria simply because they have the name of hystero-epilepsy. That electricity is one of the best therapeutic measures for hysteria is well known, and its mode of action is purely rational. It is claimed by many that the great success of electricity is due to its action upon the mind. I do not see any harm in having action upon the mind. If we can cure patients by mental suggestion, it is a great deal better than dosing them for six months. If the Christian Scientists can cure cases, as they do cure some, probably many, they certainly have the advantage over us in that they do not upset the patient's digestion, do not put drugs into the system that they do not know the action of, and do not perform a surgical operation that is liable to maim him for life. So far as the suggestion theory is concerned, if we cure cases simply by suggestion in electrical treatment, that is better than any other method of treatment. But I believe there is another rational explanation of the cures made in hysteria by electricity. Hysteria is simply due to a disordered state of the nervous system, and that disordered state is from a lack of a proper amount of nutrition, and lack of proper amount of stamina and resistance power. Now, by increasing the nutrition we build up the system to its normal condition, and thereby give it its power of resistance and cure the case of hysteria. If electricity has any action at all, if there is any action of it known in electrical therapy, it is in its power to increase the nutrition of the tissues: Therefore, in a case of hysterical epilepsy I should most certainly consider the electrical treatment a most admirable one.

Dr. F. A. Gardner: My experience has been very limited in that line, but if it is not out of place I would like to speak of a case which came under my notice about three years ago. I was called in consultation to see this patient, a young lady of about eighteen years; she had been in her room for ten months. When I first saw her she was in what I would call a perfect cataleptic condition, a case of auto-hypnotism, and the attacks would come on similarly to a case of hystero-epilepsy, and then that would be followed by this cataleptic state. She would remain in that condition from ten to twenty-four hours. She came into the menstrual period, and when I saw her she had been in that condition three days. I suggested that they use a very powerful faradic current upon the spine. That treatment was carried out, and in less than a month's time the patient was about. I think it was merely a psychological effect and nothing else.

Dr. Alice Condict: What wire was used?

Dr Gardner: It was the coarse wire.

ELECTRICAL MEASURING UNITS.

BY T. F. LIVINGSTON, NEW YORK.

The importance of uniformity and unity of plan can hardly be appreciated unless we stop to consider what constitutes a unit. If, in expressing a quantity of material, we say that it contains a certain number of times another quantity of the same material; or, if we indicate in numbers the relative proportions of two quantities, then we measure the first or larger quantity by the second or smaller quantity, as, one foot contains twelve inches. By the term quantity we must mean something that is perceptible to our senses as being greater or smaller, stronger or weaker, or capable of showing differences in gravity or force, etc. When we use, either by means of physical laws or by agreements, a certain quantity, definite and constant, for measuring other quantities, this quantity is called the measuring unit. From this we can readily appreciate that we must have as many kinds of measuring units as we have kinds of matter appealing differently to our senses. All civilized countries have for ages diligently worked upon scientific lines to produce fundamental units, and even by international scientific societies, and agreements, that in transacting commercial affairs, the unit of measuring should be identical throughout the civilized globe. As early as 1790 Washington authorized Congress to fix the standard of weights and measures. From that time to the present, various changes and suggestions have been offered; and the units or fundamental standards were changed, and not until 1890, after nearly fifteen years of assiduous labor on the part of the permanent International Bureau of Weights and Measures, which is supported by contributions from nearly all the civilized governments of the world; were the standard units of length and weight successfully completed. Their prototypes are now carefully preserved by our government at Washington. While the United States, I believe, have never adapted by a congressional law a standard fundamental unit, they recognize the importance of international units and are lending assistance to secure the same. Length is measured by meters, volumes by liters, time by seconds, weight by kilo, currents by amperes, etc. The expressions length, time, weight, etc., are terms we recognize for quantity and represent other measuring units. We have learned through the progress of time to deduce certain measuring units, from others, by the application of mathematical or physical discoveries. Thus we measure length by the meter, surface by the square meter, volume or mass by the cubic meter or liter (which is equal to one thousand centimeters) that is, we simply deduce the measuring units for surface and volume, from the meter the measure of length. Now the value of measuring units being one, as a basis we can readily distinguish fundamental measuring units and deduced units (meter and cubic meter) it is absolutely necessary to have as few fundamental units as possible, not only for simplicity of calculation, but because all the different measuring units, as the ohm, ampere, etc., must be of constant value, and, if lost, must be replenished at all times and everywhere, and the property of stability, or being the same either of value, time, weight, and force can be shown to belong to but few forces or physical phenomena. Such stable forces are for instance the dimensions and time of daily rotation of the earth; constant angles, etc., and in addition to these we accept the laws of nature and mathematics as unchangeable, we have all that is necessary for the production of physical measuring units. In fact they are made use of in the deduction of the electrical units for commercial purposes. The fundamental units adopted by various associations of electricians, from which the ampere, ohm, volt, coulomb, farad, etc., are obtained, are, first, the centimeter, or the one thousand millionth part of a quadrant extending from the equator to the north pole over Paris. The symbol of the centimeter is C. The second of time, or the one eighty-six thousand four hundredth of the even day of twenty-four hours. The second can also be exactly obtained by astronomical observations. Its symbol is S. Third, the gram, or unit of volume, symbol G. This unit has been accepted not only as volume, but mass and substance. Practically it should be designated as gram-mass. We do not simply say the gram as a weight indicating the amount of the earth's attractive force upon a cube of water, or a piece of brass, for the reason that this force of attraction differs largely in different parts of the earth, owing to the variation of gravity; hence we cannot use it in determining the electrical

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unit but in its stead we use gram-measure as an accurate mass of matter—a certain number of molecules which exists somewhere in the universe united as a whole and as a physical body possesses certain physical properties. To wit. Properties of inertia, of exhibiting centrifugal force, or on account of universal gravitation to attract one another, etc. . This mass or volume of matter which is determined as equal to one gram is determined by weight, by placing on one side of a sensitive scale the gram weight, on the other side so much matter, until both pans of the scale shall be equally attracted by the earth. That is, until they perfectly balance. Therefore when saying gram-mass we refer to the general physical properties of an amount of matter determined by the known method of weight. All the measuring units which are deduced exclusively from the centimeter, second, and gram-mass, have been named by scientists absolute measures. We have the units velocity, acceleration, force, etc. The practical measuring units used in electrical applications are volt, ampere, and ohm. The last international congress of electricians assembled in the United States in 1893 adapted the following units:

Volt. The unit of electromotive force. Which is the E. M. F. applied to a conductor, whose resistance is one ohm, producing a current of one ampere.

Ohm. The unit of resistance. Which is represented by the resistance offered to an electric current by a column of mercury, at the temperature of melting ice, 14.4521 grams in mass, of a cross-sectional area, and the length of 106.3 centimeters.

Ampere. The unit of current. Which is one-tenth of the unit of current of the C. G. S. of electro-magnetic units, and equivalent to the deposit of silver, in nitrate of silver solution, at the rate of .001118 of a gram per second.

Henry. The unit of induction. Which is the induction in a circuit when the electromotive force induced in this circuit is one volt, while the inducing current varies at the rate of one ampere per second.

Watt. The unit of power. Which is equal to ten million units of power in the centimeter-gram-second system, and which is practically equivalent to the work done at the rate of one joule per second.

Joule. The unit of work. Which is equal to ten million units of work in the centimeter-gram-second system, and which is practically equivalent to the energy expended in one second by an ampere in an ohm.

Farad. The unit of capacity. Which is the capacity of a condenser charged to a potential of one volt by one coulomb of electricity.

Coulomb. The unit of quantity. Which is the quantity of electricity transferred by a current of one ampere in one second.

For the sake of brevity I have omitted the most intricate part and have attempted to simplify the expressions, at the same time not losing sight of the importance of the fundamental C. G. S. units which are essential, and revealing the importance of accurately constructing instruments. For accurate work and universal results it becomes necessary to recognize standard measures. How little do we consider the true value, the time and energy represented, in approaching correct measurements. Daily contact leads us to a superficial idea as to what correct units are; and their derivation. We are liable to fall into the error that measurements are readily accomplished, and consequently accept the general statements that this, that, or the other, represents devices of accurate measurement; when, upon the other hand, if we stop to carefully consider we could readily appreciate that accuracy of device must add expense to construction. As a society we should lend our efforts to the forcing of more accurate measurements, thus adding unity and uniformity to our labors throughout the universe. The science of electro-therapeutics has been retarded for the want of means and devices for tabulating the researches of those interested at different distances apart. Rapid advancements in the last few years have greatly assisted in the production of more perfect devices, and we now look forward to a better condition and a more accurate tabulation of records. Yet we must keep a vigilance as to the instruments used. If we desire to weigh, divide, or portion out in material substance, we should do so with such means as will prove satisfactory to all interested, and leave but little question of doubt. Let us exercise diligence, and by hard labor we may in the near future secure more ideal instruments.

Discussion.

MR. OSTERBERG : The paper is a very interesting one, because it is very concise. It might be somewhat shortened, then it would be a most valuable paper that anyone might have and learn by heart. Mr. Livingston takes four or five lines in definition of quantity. Quantity may be defined as anything that can be increased, diminished, or measured. The units he has deduced in an interesting manner, but one very valuable point he has left out, and that is that the velocity of electricity, which is one of the derived units, is exactly the same as the velocity of light.

As far as the United States are concerned, they have no legalized units at all, but they are measuring everything according to the standard preserved in Washington. This is a very interesting piece of apparatus. I might say a few words about it. There is only one absolute meter in the world, and that is kept in one of the Bureaus of Paris. This is kept at a constant temperature under glass, and was made at the beginning of this century; it is wrong, however, since the actual centimeter is wrong. The meter is not the $\frac{10}{1,000,000}$ of a quadrant of the earth's surface; it is out by something like $\frac{8}{1000}$ of a millimeter. At that time the instruments for surveying were not nearly so good as in 1835–40. If the meter was lost it could never be reproduced, because the surface of the earth changes; the surface of the earth has increased by several centimeters in diameter during the last 110 years: so that even if the earth's quadrant had been measured correctly, it would not be correct to-day. The earth, in traveling through space, takes small particles from the universe, and in that way increases; so we have no absolute unit. There is one absolute unit that has been suggested by James Clark Maxwell. Professor Michelson of Chicago University was called to Paris to make an investigation (and it was quite an honor, for he was the first American called upon by the French Academy to make a scientific investigation) of Maxwell's suggestions, which were to use the D line of the spectrum. The spectrum is always of a definite length, so sodium was selected to be represented as the unit; it comes up almost to a centimeter; it is the same, no matter in what part of the world we are, and nothing in the world could ever change it. It took nearly eight years to prepare the original meter. If one wants to measure it, he must have permission from the Consul, if he is a foreigner, or permission from the Government, if he is a Frenchman, to be allowed to open that box. Now, in case of a question with France, it was considered proper that America should have a standard, and of course it would be impossible to have the identical measure. So, the way it was done was to have a number of platinum-iridium plates made, approximately 102 centimeters long; the first, when measured, was found to be considerably out, another was made, and they continued to make them until the total average for all those made should be exactly one meter; it took thirty-five to produce that. They would have gone on indefinitely if they could not have produced it. Luck might have had it that it would have been the second one, but there were thirty-five, and those thirty-five are now preserved in Washington in the same manner as the original in Paris.

With regard to Mr. Livingston saying that very few units are necessary, every system becomes the more exact the less units we have to it, in the same manner as any science is the most exact by having the fewest hypotheses on which to base the entire science. Geometry is generally considered the most exact science, because it is based upon three axioms. Algebra is not nearly so exact because it is based upon certain conceptions. Physics is extremely exact, because it is based upon three concepts of the mind: matter, time, and space. I suppose when we come to medicine we have practically no fundamental axioms, and will not have until the actions of life are reduced to purely physical processes.

CATAPHORESIS AS APPLIED TO SENSITIVE DENTINE RENDERING DENTAL OPERATIONS PAINLESS.

BY CHARLES G. PEASE, M. D., D. D. S., NEW YORK.

I will not trespass upon your time in writing at full length upon so limited a subject.

We are still experimenting, for although the results which have been obtained by cataphoric action upon the dentine have been satisfactory, in the light of our present knowledge and in view of the purposes for which it is employed as limited by the scope of this paper, yet we do not know what the future may reveal.

The question arises—is there any damage sustained by the pulp that will result in permanent injury and final death, through driving or carrying the obtruding medicament into the toothbone and pulp? (Arsenic of course not being used, cocaine being largely employed, as also some of the essential oils.)

To this question I reply—we have not been able to discover any damage to the pulp in cases in which anæsthesia has been produced by cataphoresis, up to the present. Whether any of these pulps will ultimately die as a result of the treatment time will tell.

Years may be required before we can positively say they will not.

The fraction of a milliampere of the current will produce pain at the onset when applied to sensitive dentine, therefore the utmost care is required in controlling and graduating the current, which should be gradually increased, each increase of current causing pain at first.

In seven to ten minutes there will be no pain on increasing current, which is then carried to 2 or 2½ milliamperes, and continued for three or four minutes. Operative procedures may then be endured without pain.

During the application of the current the applicator should not be removed from contact with the part that sensation may be avoided by reaction of current, and the current should not be increased until the pain of the previous accretion has subsided, and it is also advisable to place the medicament used into the cavity of the tooth about five minutes before the application of the current. This will modify the pain of first contact.

The medicament is conveyed into and retained in the cavity by means of a small pledget of cotton the size of the cavity and the applicator is placed against the cotton, which should be kept well saturated with the medicament by means of a pipet or other instrument.

In a recent operation a mesial approximal cavity, the dentine of which was extremely sensitive, was subjected to cataphoric treatment and then thoroughly excavated without pain. A disto-approximal cavity was then discovered in the same tooth which was cut out without the cataphoric application and without any pain whatever, showing conclusively that the pulp had been invaded by the medicament sufficiently to anæsthetize it, and the whole tooth could have been cut to pieces without pain.

This is a great accomplishment and a boon to the sensitive patient.

The rubber dam should be applied before making the application.

I will not burden you with a description of the instruments or with a further discussion of the subject.

Discussion.

Dr. Louis C. Le Roy of New York in discussing the paper said : Dental cataphoresis I believe will be the method for performing many dental operations in the future, but for the present the apparatus is too crude and uncontrollable for general practice.

Frequently the pain attending the application of the process is more intense than a cautious operator without attempting electrical anæsthesia would possibly inflict, and I was present at one clinic where cataphoresis was a failure ; the cavity of decay seemed hyperæsthesed. Thinking the poles of the battery were wrongly connected they were changed, and the current gradually applied again, with the result that the patient was obliged to howl for relief. Under the circumstances I feel content to witness an occasional clinic until the apparatus becomes so modified that the practical value of the instrument will be somewhat assured.

A FEW EXPERIMENTS WITH THE FARADIC CURRENT ON A HYPNOTIZED SUBJECT.

BY F. A. GARDNER, M. D., WASHINGTON, D. C.

During the early fall of 1895, while a professional hypnotist was exhibiting in Washington, I called upon him and asked permission to experiment with the faradic current upon one of the subjects while under his influence ; my request was readily granted and an hour appointed.

With the assistance of Dr. Hawxhurst, the following experiments were made :

After the subject was hypnotized and put into the cataleptic state, he was laid upon his back, one pole was placed in palm of each hand and the whole force of the battery turned on, " which was a dry cell, chloride silver, with cells of double the ordinary size, made for a special purpose, with coil of No. 20 wire." No effect was noticed. One pole was then placed behind the left ear, the other remaining in the hand of same side ; this produced no effect. The pole was then removed from the left hand to the right ; this caused the most violent contractions through the left side, head, neck, right shoulder, and arm ; current was then passed through the head, both poles behind the ears, then through the temples same way, with no result in either case. One pole was then placed behind the ear and the other moved over branches of facial nerve, causing violent contractions of the muscles on that side of the head and face. The subject was then turned on his right side, one pole applied to base of the brain, the other to the end of the spine; this caused the head to be thrown backward and a condition similar to opisthotonos produced. He was then placed upon his back while subject No. 2 was experimented upon.

He was hypnotized and told to take a pole in each hand, the whole force of the battery was turned on, causing violent contractions but no pain; said he did not feel it; one pole was then placed behind the ear and the other passed over the branches of the facial nerve, one-half strength of the battery; this caused contraction and so much pain that the patient refused to allow its use again; a lancet was immediately used over the branches of the same nerve in several places, causing the blood to flow freely, but subject did not feel any pain.

The attention of the hypnotist was then called to the condition of subject No. 1, who was breathing very heavily, and his face having assumed a cyanosed appearance; it was with the greatest difficulty that he was brought out of the cataleptic state. The electricity had tended to put him more thoroughly into that condition, causing no little uneasiness and apprehension on the part of the hypnotist.

He then acknowledged that in subjects difficult to hypnotize in his public exhibition he used a faradic battery connected with copper plate in the floor of his stage.

I asked permission to examine the stage, which was readily granted, and found the plates in the floor and the wires leading to the battery in a small room off the stage.

Discussion.

Dr. H. E. Waite: I was trying to think of the name of that little wonder that was carried around the country, that had such immense strength. We had a letter from her manager, who wanted apparatus that could be fastened on her body. Very likely she used the same method for producing the current.

Dr. Wm. R. King of Washington, D. C.: I would like to ask the doctor whether he inquired of the hypnotist in question whether it was the usual course with hypnotists, where they had a subject difficult to get in the hypnotic state, to use the faradic current.

Dr. Gardner: He did not tell me.

Dr. W. H. King of New York: This paper is entirely new so far as I know; as I understand Dr. Gardner to say, for muscular contractions the current must be given along the course of the nerve.

Dr. Gardner: Otherwise there is no result so far as I can see.

Dr. King of New York: I would like to know if, when he gave electricity to hypnotize them more deeply, he gave it down the course of the nerve.

Dr. Gardner: No, the plate came up out of the stage. He had a copper shoe on the bottom. The current passed over the patient's head and the patient commenced to feel the current lightly.

Dr. King of New York: It was not turned on until then?

Dr. Gardner: The battery was in the ante-room and the current was turned on all the time.

Dr. King of New York: Did the patient know, after you had finished, that he had had electricity?

Dr. Gardner: No, he did not know anything about it.

Dr. King of New York: When passed during the cataleptic state did he know nothing of it?

Dr. Gardner: In the cataleptic stage they knew nothing about it. You can use the scalpel, and they will not feel it. In the hypnotic stage if you turn on the current again they will fight against it.

Dr. King of New York: There is a very interesting physiological point there in following the nerve to produce the contraction.

Mr. Osterberg: When the patient comes in in ordinary cases is he aware that he is put under this plate?

Dr. Gardner: No. He has but one chair arranged in that way, and if he has tried the subject before, he puts the one that was difficult to hypnotize in that chair.

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THE TOOLS WE WORK WITH.

At the last meeting of the National Society of Electro-Therapeutists a paper read under the title of "High-Tension Currents" brought forth a discussion in the way of advice to the editor of this JOURNAL. The paper referred to did not treat of the technique of high-tension currents, but was rather a dissertation on selecting the right kind of a battery, one which would contain the proper material, and whose construction would be of a class of workmanship that would give the required tension, smoothness, and durability. It appears from the stenographer's report that two prominent members arose to give their hearty commendation to the paper, and one, no less a person than the President-elect, stated that the editor of this JOURNAL should emphasize the same precept through its columns. We would say that we have always tried to carry out these very ideas; not only have original articles set forth the necessity of purchasing good instruments, but various editorials have been written to emphasize it. No matter how many times it has been said, it cannot be reiterated too often.

The question at hand can be brought home to the general practitioner, perhaps, more forcibly by comparing his electrical apparatus with the medicines he prescribes. Take, for instance, a case in which he has labored hard to make a diagnosis, carefully discriminating on the remedies he selects for his prescription—his reputation is to a degree at stake on the success of this prescription; and this same prescription is taken to a cheap, unreliable pharmacist who fills it with cheap, unreliable drugs. The consequences are the prescription fails to produce the desired result. How long would it be under these circumstance before the physician would be forced out of his profession and be glad of the opportunity to drive a horse car? Every physician who is worthy of his profession is most careful of the character of the druggist who fills his prescriptions. He even specifies the maker of the drugs and sees to it that the pharmacist is reliable and honest.

These same physicians buy a battery of makers without knowing or even inquiring of its special construction, simply because it is cheap. A battery is a battery for them, no matter what may be the size or length of wire of the coils, electromotive force, kind of cells, or its general construction. The only thing they require of it is that it gives off a sufficient strength of current, and the strength of current in this case would simply mean a galvanic battery which produced an intolerable burning, and a faradic battery which would cause the muscles of the forearm to rigidly contract when the electrodes were held in the palms of the hands. Why this difference? Why does the physician look after the preparation of his medicine so carefully and be so negligent in the selection of his batteries and electrical instruments? It is simply due to the training which he has had during his college course, and all his reading and experience since his graduation has taught him the great necessity of being careful in the selection of his drugs. He has learned their various properties, the clime they come from, the time they should be gathered, the way they are prepared, and knows this is all necessary in order that they retain certain properties which are essential to their usefulness. On the other hand, he has simply heard that electricity is good for certain conditions; perhaps he takes the trouble to look up how it is to be given and the kind of electricity, whether faradic or galvanic. He does not, however, know anything about the battery itself; he knows nothing of the action of coils constructed of wires of different lengths and sizes, or any other part of the physics or physiology of electricity. He therefore does not recognize the necessity of being as careful in selecting them as he is of his drugs.

The cause, then, is a natural one; the true remedy is not to expatiate on the necessity of buying good batteries, but to educate the physicians in the branches of electro-physics and electro-physiology; they will then understand the necessity of buying the best. We are glad to say that this is being done by the introduction of lecture courses in the medical colleges, of formation of post-graduate courses, and the large increase in electro-therapeutic literature. Let this work continue, and it will not be long before the dishonest battery makers will be driven to the wall as the cheap drug manufacturers have been.

BOOK REVIEWS.

THE X-RAY, OR PHOTOGRAPHY OF THE INVISIBLE. By WILLIAM J. MORTON, M. D., in collaboration with EDWARD W. HAMMER; American Technical Book Company, 45 Vesey Street.

A small paper-covered book, selling at the cheap price of fifty cents, containing about two hundred pages, is one of the latest of the numerous books which have recently appeared on the X-ray. The authors of this book describe quite fully the various forms of apparatus necessary for the generation of the X-ray. Of course, the static battery is quite fully given, but we are sorry to note that the authors only give the static induced, which is a very inferiör form for production of X-rays. The static induced is an alternating current giving off in opposite directions the small induced charges on the outside of the Leyden jar, and never has become a prominent factor in the production of X-rays. However, with an attachment which utilizes the discharge from the inside of the Leyden jar, therefore, a direct instead of an induced charge (so far as the Leyden jar is concerned) it not only surpasses the static induced, but surpasses the discharge from any Ruhmkorff coil we have ever seen in the production of X-rays. This must have been known before the book was published, and it is with sorrow we note its absence. The different forms of tubes are then described, with practical rules for the use of X-rays. An appendix of fifteen pages, a voluminous index, with a number of skiographs, complete the work. The book will assist one much in undertaking to master the technique of the production and the practical use of the X-ray.

ROENTGEN RAYS AND PHENOMENA OF THE ANODE AND CATHODE. By EDWARD P. THOMPSON, M. E. E. E., Author of "Inventing as a Science and Art." Concluding Chapter by Professor A. ANTHONY, with sixty diagrams and forty-five half-tones. D. Van Nostrand & Co., N. Y.

The author has arranged the accounts of the experiments of a large number of physicists in 210 paragraphs, each with authorities and numerous cross-references, and he shows the lesson taught by each experiment.

Beginning with the investigations of Faraday, Wheatstone, and others, he leads from discovery to discovery to the work of Crookes, Herz, Lennard, and Roentgen and the X-ray, and discusses its properties. He then considers the work of Edison, Tesla, and other modern investigators.

The final chapter on "Theoretical Considerations" was written by Professor Wm. A. Anthony. He explains that the transmission of energy may occur (1) by the actual transfer of energy-bearing matter or (2) by wave motion. The latter should show evidences of the penetration of the geometrical shadow, interference phenomena, should be susceptible to refraction, and, if transverse, polarization. None of those is definitely proved of the X-ray, while he doubts the Tesla explanation that the phenomenon is due to molecules of the gas being "kicked out of the tube," and he says that the rays may be ether streams, though we do not know if they would *do* what the X-rays do.

He concludes by saying, "Before accepting any stream or vortex motion theory, we need to know more about the X-ray phenomena, and more about stream and vortex motion."

It is safe to say that a more interesting work on the X-ray has not been published.

A TREATISE ON ARTIFICIAL LIMBS. (Special Edition, 1896. Sent free on application.) A. A. Marks, New York.

There are a number of articles in this book that should interest every professional man. We call attention to the following: "The Importance of Applying Artificial Legs to Young and Growing Children," "The Aged," "The Longevity of the Maimed," "Amputations Prothetically Considered," "The Relation of Surgery to Prothesis."

EPITOMES.

MORE POST-GRADUATE WORK.

Dr. F. M. Frazer of this city has established a post-graduate course. He takes his students to the Metropolitan Hospital on Blackwell's Island three times a week, where he has plenty of clinical material, as he has the selection from eight hundred beds. Twice a week he holds an out-patient clinic at the West Side Dispensary. He also lectures twice a week. This should be a most instructive course, as the Metropolitan Hospital will furnish a bedside experience which is not common to electro-therapeutic clinics.

Galvanism in Nymphomania.—Dr. T. W. Musgrove has had experience in the use of a strong galvanic current in nymphomania. The anode is used internally and the cathode upon the abdomen. Galvanism will be sure to help, if there is no spinal disease.

Caked Breast.—Dr. Chester G. Higbee, in the Homeopathic Journal of Obstetrics, says that he knows of nothing that will "resolve cakebreast" as well as electricity, followed by gentle massage and rubbing. "Always rub from the nipple back toward the axilla."

Dilating with Faradism.—A New Method.—Dr. Jennie W. Martine recommends a "simple, painless method of arriving at this result without discomfort to the patient." The doctor introduces an insulated sound, having a free tip of two inches, and the faradic current turned on according to the sensitiveness of the patient. When the patient ceases to feel the current it is made a little stronger until the sound becomes loose, and then the current is turned off, the next size sound selected, insulated, and inserted, and so on until the desired dilatation is attained.

Therapeutical Influence of Repeated Currents.—Professor d'Arsonval read a paper before the Academy of Sciences in Paris on the therapeutic influence of frequently repeated currents. Two diabetic patients and another, who was being treated for obesity, were placed under Professor d'Arsonval, and after a six weeks' treatment the urine passed daily was reduced from 12 liters to 6 liters, and the sugar was reduced from 620 grams daily to 180 grams. Similar results were attained in treating a female patient—a daily excretion of 138 grams of sugar being reduced to 38.

Conversion of Toxins into Vaccine under the Influence of Electricity; the Action of Currents of High Frequency.— Professor d'Arsonval and Dr. Charrin have called attention to the fact that it is possible to attenuate toxins by passing through these substances a continuous or interrupted alternating current.

The results vary according to the intensity of the current, the amount of volts, the potential, etc. It is thus possible to attenuate sufficiently the noxious properties of these microbial secretions, while preserving, at any rate partially, their vaccinating power.

On January 2, 2.5 cubic centimeters of electrized pyocynic toxin were injected under the skin of 5 guinea-pigs. On January 27, these 5 guinea-pigs were inoculated with 1 cubic centimeter each of a culture of the bacillus pyocyaneus, and the same was done with 5 other normal guinea-pigs. From January 29 to February 1, the 5 control animals died, whereas in the evening of the latter date only one of the vaccinated animals appeared to be very ill.

The results obtained in similar experiments with diphtheritic toxin were less striking, 3 control animals dying first, it is true, but of the 6 vaccinated ones, 2 survived only a few hours longer, while the other 4 were ill. Nevertheless, the increase of resistance, though slight, was unquestionable.

Among later results obtained one of the most important is the attenuation of these toxins by currents of high frequency, reversing over 200,000 times. Under such conditions there is no trace of chemical action, nor of polarization. On the other hand, a current of water prevents the temperature from rising.

These profound changes can only be attributed to the fluid itself and to molecular action. It is well known that these currents, the power of which exceeds that necessary to kill a man, may be sent into living organisms without determining the least pain.

We have ascertained that, in this form of electrolysis, the current employed is very active. Guinea-pigs, into which 3 cubic centimeters of diphtheritic or pyocyanic toxin were injected under the skin, after having been subjected for an hour to the action of either the positive or negative pole, with a discharge of three hundred coulombs, survived, while the test animals died within less than two days.

In the first place, it was proved beyond doubt that this is not due merely to polar effects, and that the passage itself of the fluid exerts a modifying influence.

Wishing to push our investigations farther, we employed electricity in a disconnected manner, diminishing considerably chemical decomposition, which enabled us to ignore the part played by electrolysis. From three hundred coulombs the quantity of fluid fell to a few units.

Under these conditions, the two toxins employed were attenuated to such an extent that doses, ordinarily lethal within from two to four days, determined at the most emaciation, and this was sometimes more marked with the product which had been subjected to the influence of the negative pole.

This method of varying the toxicity of these microbial substances consequently possesses certain advantages over filtration, heating, etc.

Vaccines and antitoxic substances may be prepared in this way, and it may even be possible to go still farther, especially with currents of high or low frequency. In order to know what is done, however, it is of importance to carefully determine the volts, amperes, and potential. If these indications are absent, even the nature of the agent employed, *i. e.*, the form in which the energy has been expended, is unknown, for it is quite possible —and this fact cannot be too strongly insisted upon—that only a chemical action or caloric effects, but not electrical influences, have been brought into play.

Be this as it may, we have here an active agent, the energy, form, rapidity, intensity, duration of application, pressure, etc., of which vary and thus cause the results to vary, from the most insignificant changes to the complete disappearance of every noxious property, while the vaccinating properties are preserved. —*The Medical Week.*

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NEW YORK, APRIL, 1897.

ORIGINAL ARTICLES.

"A NEW SYSTEM OF APPLYING THE ELECTRICAL CURRENT THERAPEUTICALLY"—AN ABSTRACT OF THE PAPER.

BY LIEUTENANT F. J. PATTEN, NEW YORK.

In this paper, entitled "A New System of Administering the Electric Current Therapeutically," Lieutenant F. Jarvis Patten described a method for applying the electric current by producing an alternating current from a direct current by means of electrodes revolving in a receptacle containing acidulated water. Lieutenant Patten stated that the method consisted in applying as nearly as possible a uniformly varying alternating current of absolutely unbroken continuity at a frequency of about one or two per second. He stated that he believed these to be essential features in the therapeutic application of alternating currents, the voltage following that of the true sine curve such as shown in Fig. 1. A voltage of this kind could be produced by a specially constructed dynamo, but it would be a difficult matter to get a low-frequency condenser, as the lowest machine speeds would be too high.

He stated that alternating currents for commercial machines often produced sudden and irregular changes of voltage, due to the presence of iron and rapid reversals. The irregular curve in Fig. 2 shows in a general way the current delivered by ordinary induction apparatus, and supplied with an interrupted current from a battery or other direct-current source. The changes in the voltage are sudden and irregular, and the breaks are of comparatively long duration. Fig. 3 represents approximately the voltage curve of a commercial alternator with iron armature, the fluctuations of voltage of which are not so irregular, but the frequency is very high.

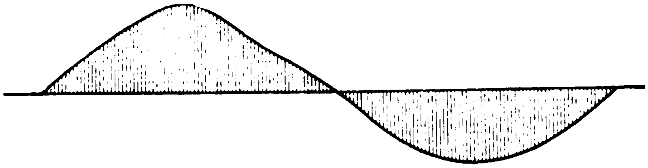

FIG. 1.

An alternating current of uniformly varying voltage, free from sudden interruptions and of very low frequency, can be produced by properly designing the apparatus shown in Fig. 4. A circular vessel or tub, containing acidulated water, is made of insulating material and provided with two carbon or platinum electrodes, C_1, C_2, which are connected to direct-current street-lighting mains, or to a battery as indicated. A vertical spindle in the center of the vessel supports the horizontal arms, also of insulating material, and carrying at their extremities revolving carbon or

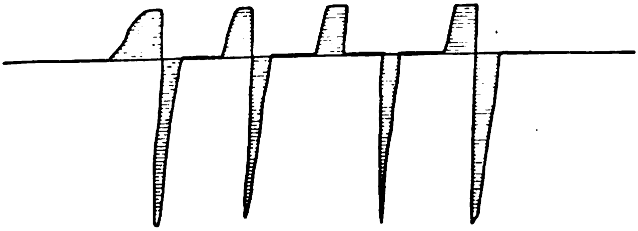

FIG. 2.

platinum electrodes, C_3, C_4, which latter are connected to the insulating ring contacts, R_1, R_2, fixed on a spindle and upon which bear the contact brushes, H_1, H_2, from which the transformed current is taken to the operating circuits connected with the terminals, A_2, B_2. The current from a battery or house circuit being turned on, the movable electrodes are revolved slowly by an electric motor or clockwork, and a uniformly varying and unbroken alternating current of as low frequency as may be desired is delivered to the operating circuit, A_2, B_2, from which any desired form of electrode, or other means may be used to supply the current to the subject.

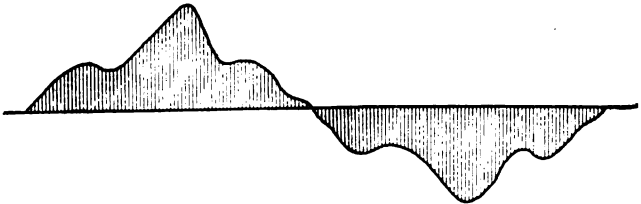

FIG. 3.

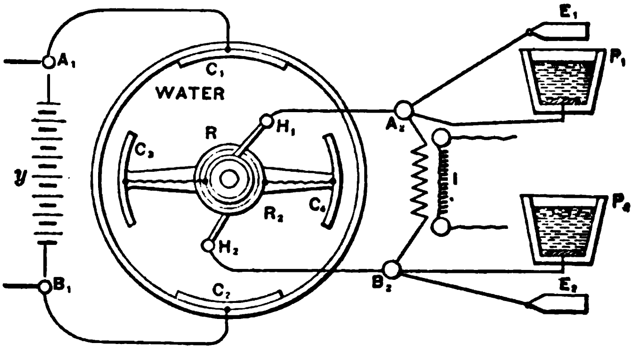

FIG. 4.

Among others there is indicated a pair of tubs or pails for immersing the hands or feet, thus giving a current to the upper and lower extremities of the body. The apparatus is very simple and cheap, cannot get out of order with ordinary use, and transforms an ordinary street-lighting current of 220 volts, or that of an ordinary battery, to a uniformly varying current of any desired voltage and frequency. If the battery is used, the voltage will probably be too low, in which case the transformed battery current should be passed through an ordinary step-up transformer, which can be connected to give any desired voltage. Thus, with a dozen cells of storage battery and an ordinary 110-volt direct-current lighting circuit at his command, a physician with this apparatus can have what has some promise of being the best form of alternating current for medical use.

If the revolving plates or electrodes are made adjustable in position to and from the center on the revolving arm, then, by moving them toward the center, a liquid resistance is thrown in the operating circuit, thereby reducing the voltage of the street circuit by any desired amount. By thus connecting the revolving mechanism, the water can be used as a mere passive resistance, so that the ordinary house-lighting circuit can be reduced in voltage sufficient to heat cauterizing instruments. The apparatus can be made in a compact form, about a foot or fifteen inches in diameter for individual use, or larger if desired, to carry heavy currents for subdivision among many operating circuits.

DR. W. H. KING, of New York : This subject of alternating currents in medicine is yet so crude, that is, the action of it upon the human system, and so little is known about it, that it is impossible to give any idea in a discussion of what we may expect. I have had very serious doubts, from what I have seen of very high frequencies, whether they produce any osmotic or catalytic action upon the system. I do not believe for these high-frequency currents we have ever had a better machine to produce the alternating current than the Kennelly alternator ; and I have yet to find any electro-physiological action or any particular therapeutical action that could be attributed in any way to what we know as the action of electricity generated by it. It seems to me as if we had here a form of the alternating current in medicine different from any we have had before. We have one of a lower frequency than the faradic and we have a different current because we have a true sinusoidal current. I believe that with the very high frequency alternating currents the impulses act simply as impulses—a sort of bombardment. I do not believe there is the slightest electrical action. I do, however, believe there is a certain amount of massage of the body from the impulses given. I have often wondered why specialists on the ear, who seem to have gone daft on the subject of aural massage, have not taken up the alternating current and seen its power in that direction. I believe that the impulses given by the alternation of the currents would produce great results in the massage of the ear. With the current from Lieutenant Patten's machine, it seems to me we might get some catalytic action as well as some new action which we have never obtained from any other instrument.

Dr. Gardner, of Washington, D. C.: I have used the machine made by the McIntosh Company, and it has given me very little satisfaction. In the first place, when first sent to me, there was no way of regulating the current: either the patients felt none at all or else it came with a rush and seemed to do them up in a knot, as they expressed it. The machine was sent back, but when it was returned to me it was very little better; very little satisfaction could be obtained from it. The patients complain now that the current comes in waves, with intervals of fifteen to twenty seconds between them. It will go down to nothing and then gradually rise and then fall again.

Mr. Osterberg: You just get the same kind of discharge that Lieutenant Patten spoke of which threw him ten feet, due to some internal trouble with the machine, some loose connections or some trouble of that kind.

Dr. Gardner: When the alternations are slow they do not feel it, but when the current is turned on with any force it burns so they cannot bear it.

Dr. Waite: I would like to ask you a few questions about your diagram, because we are not familiar with its working principles.

Lieutenant Patten: In the first place, this is a dish, a receptacle for holding water. As the current comes through the poles it changes direction, going from one revolving pole to the other, causing an alternating current, very gradual, not sharp. This circuit is never broken. It is entirely uniform, because you have no sharp break.

I may say I do not like 110 volts to play with, but I have taken 300 with that contrivance without the slightest inconvenience.

Dr. Waite: That can be used as a water rheostat?

Lieutenant Patten: The current can go equally through one or the other circuit, and so is balanced.

Dr. Waite: In medicine it would make a very pretty rheostat to control the current. I think it is a good and unique apparatus. I have never seen anything like it.

Lieutenant Patten: I first used it four years ago last March.

AN INQUIRY INTO THE TREATMENT OF RHEUMATIC ARTHRITIS.

BY F. M. FRAZER, M. D., NEW YORK.

As a rule, it is not safe to generalize from a single case, especially when the case has not been cured; yet a single case may prove instructive, and suggest further experimentation. For this reason, I call the society's attention to a case of rheumatic arthritis I had last winter.

Two years ago, Dr. Gardner read a paper on this subject before this society. I have tried his method with considerable success. It, as you all know, consists of the use of the negative pole with a soft clay electrode surrounding the joint, followed by massage.

Dr. King, when professor of electro-therapeutics at the Metropolitan Post-Graduate School of Medicine, tried a solution of benzoate of lithium in connection with the positive. The case came twice, I believe, and then discontinued treatment.

After Dr. King's resignation, when I succeeded to his position, a similar case came in, having all the joints of both upper extremities involved. Thinking that this would be an excellent case to exhibit the comparative value of the two methods, I gave instructions that one hand should be immersed in a solution of benzoate of lithium, connection with the positive to the fluid being made through aluminum; while the other hand was immersed in water (a little salt being added to increase the conductivity), which was connected with the negative.

This latter is a modification of Dr. Gardner's method.

I omitted the massage he uses, because I wished to determine, as far as possible, the effect of electricity unaided by mechanical procedures. The substitution of water for clay, excepting for increased density of current at the surface, is irrelevant. The effect of the decomposition of the salt I cannot consider now, as I have no data. Otherwise, the conditions were equal. The current used varied on different days, according to toleration, from 30 to 50 ma., and the length of treatment from ten to twenty minutes.

After two or three treatments, the patient said that the positive hand—that with the benzoate of lithium—was improved, an improvement which became more manifest with succeeding treatments. The negative hand—that with the sodium chloride—showed no change subjective or objective.

Those members who are stronger practically than theoretically will not object to a brief statement as to what occurs in the electrodes during the passage of the current.

In the positive electrode, the benzoate of lithium is decomposed; the benzoic acid radical going to the entrance of the current into the electrode, while the lithium would travel toward the immersed hand, appear on its surface as an hydroxide, and, by electrical osmosis—endosmosis—cataphoresis—be thrown into the tissue. As lithium enjoys a great reputation in rheumatic affections, it is probable that this is the reason of the improvement in my case; if so, any soluble salt of lithium can be used with equal advantage, and the cheapest is the best.

In the negative electrode, the sodium chloride is decomposed, and the sodium—or, as it there appears, sodic hydroxide—is liberated at the exit of the current, at the connection of the liquid electrode with the negative of the battery. The acid radical, the chlorine in this case, would be driven by electrical exosmosis—anaphoresis—into the tissue; but chlorine has no effect, so far as we know, on rheumatic affections. It seems to me, therefore, that some soluble salt should be sought for which has a radical enjoying equal repute with lithium for curing rheumatism. Salicylate of soda seems to be indicated. Suppose, then, the positive electrode contained a lithium salt, and the negative electrode a salicylate—what would be the result? I don't know. Perhaps if I can get the cases by next meeting which I hope to have in my clinic on Blackwell's Island, I can tell you.

My object in writing this paper is to have some, many of you, help me solve this very important problem. Further, I probably cannot get, even on the Island, more than fifteen or twenty cases in the next year, which is quite insufficient to consider as authoritative; but if each member of this society would send me reports of three, we would have over five hundred cases, which would give absolutely conclusive data.

Dr. William H. King, of New York: I have used the method that was originated away back—I think the late Dr. Butler referred to it, copying from some German authority. It was afterward used quite generally by Mr. Edison—at least, he talked about it largely; whether he used it or not I do not know, but it was in the newspapers, and I had applications from a great many to treat them according to the Edison method. He simply used lithiate in one jar, in which he placed the positive pole, and chloride of sodium in the other to decrease the resistance. I substituted the benzoate of lithia for the ordinary lithiate. I did not know exactly in what way it would act, but the late Professor S. P. Burdict used the benzoate of lithia internally as a specific, he believed, for this rheumatic arthritis in the fingers. I have seen good results; in fact, I have never seen anything as great from the internal administration of drugs as in the use of benzoate of lithia in this rheumatic arthritis of the fingers, and it was from that idea that I used the benzoate of lithia in the solution. I believe, however, that if anyone would try the benzoate of lithia and the ordinary lithia dissolved in the positive jar, they will find decidedly more, or noticeably more, improvement from the benzoate of lithia than from the lithia. This may be due in part to the fact that the benzoate of lithia I have obtained has been of much finer quality, while the lithia I have had has seemed to be more insoluble, and I did not get the solubility that I did from the benzoate of lithia; at all events, in my hands, the benzoate of lithia has proved of decided advantage. There is one point, however, that I wish to call attention to, and that is, if this treatment is given for any length of time it is likely to weaken the patient, if given too frequently. This is more marked if the current is reversed; that is, if you use the positive pole on the one hand, and, later, the same pole on the other, reversing the current to and fro, it has a more general depressing effect on the system than when given in one direction. It is something like the effect of the galvanic current in irritation of the spine.

Dr. Youngman, of Atlantic City: I was present at the time that Dr. Gardner read his paper, and was under the impression that he did not advise cataphoresis—isn't that so, Dr. Frazer?

Dr. Frazer: He did not use cataphoresis then.

Dr. Youngman: He did not use cataphoresis there. The results that he got were in altering the nutrition about the joint. He did not use benzoate of lithia or anything else. He used simply electricity and then followed it with massage. The power of lithia over deposits about the joints is nil; it has not any power in any shape; I have been experimenting for ten years with lithia. The whole thing is based upon the fact that lithia will break up uric acid and some of the uric-acid products, particularly urate of ammonia, in a test tube; but when you introduce it in the human mechanism it has no power at all. Lithia water, Londonderry, and the rest of them, are simply of value for the water; what lithia is in them goes into the blood and becomes quickly converted into a phosphate, which is inert. More than that, in arthritis deformans we have a deposit of urate of soda and urate of lime about the joint, and we have the inflammatory condition that these irritant salts set up. If there is any virtue in the method of either Dr. Gardner or Dr. Frazer, it is in nutrition by stimulation, absorption, etc., from. the electricity, not I am convinced, from any medicament that the water contains.

Dr. Frazer: I was speaking to Dr. Gardner last evening. He has changed his treatment somewhat now, and uses for one hand the method as he described it two years ago, with the clay electrode. The other hand he puts in a solution of benzoate of lithia; he continues that for a while and then reverses the current; he says he gets excellent results.

I have been trying to keep the hands in my case separate—I have had only one—to see which hand gets well the sooner. If it were from the stimulating effect of the current—the extra nutrition, we should expect that the hand about the negative pole would get the greater nutrition, because the negative pole is more stimulating than the positive: but in this case of mine the hand about the positive pole is the one that is recovering; the negative hand shows no change. So it would seem that either the positive pole or else the lithium had something to do with it.

Dr. Youngman : I think it is the positive pole, because we know what is the action of the positive pole ; for instance, if you take where it is used in arrested growth, the positive pole stimulates absorption always. More than that, with all due respect to Dr. Frazer, I do not think you can predicate on one case the value of this treatment. I think it is due to the stimulating effect, the stimulation from the electric current, and not due to any medicament there is in the water, and I think the solution in which the positive pole is immersed would be the one that would apparently give the best results.

TINNITUS AND DEAFNESS TREATED BY THE SIMULTANEOUS APPLICATION OF ELECTRICITY AND MASSAGE.

BY WM. R. KING, M. D., WASHINGTON, D. C.

It may perhaps be as well to preface this brief paper with a few words relating to aural massage, or ossicular massage, as it has been termed, in order that a better understanding may be had by the members of this Society of the objects to be attained by this method of treating deafness and tinnitus aurium, and of the obstacles which have so far been met and which often militate against the hoped for success.

It is well known by the profession in general, I opine, that no affection of the auditory apparatus gives the aurist so much annoyance and worry, or is beset with so many apparently insurmountable obstacles to the accomplishment of satisfactory and permanent good results, as the one of catarrhal deafness. It is an extremely common trouble in this country and perhaps especially so in this section of the country, and has long been a " thorn in the flesh " of the conscientious specialist. It has, of course, been the field for the unprincipled charlatan, and each day we may find in the advertising pages of the daily papers statements of the wildest nature regarding the wonderful results of the treatment applied by some scheming Tom, Dick, or Harry. These parties find many willing victims, who oftentime regret later the loss of much of the hearing which they possessed before being gulled.

To be brief, my attention was called in 1887 to some experiments conducted at Kendall Green, a United States Government institution for the deaf, located at Washington, with a view to stimulating and improving the hearing power by means of sound waves methodically conducted to the membrana tympani in a magnified degree. The results were reported and the instrument exhibited at the meeting of the American Otological Society at New London in the fall of that year.

As soon as possible, I had a conference with the inventor of the instrument, and together we treated a number of my most stubborn cases. The results were decidedly encouraging and were reported in the *Hahnemannian Monthly* in July, 1890. Recognizing that the sphere of this method was limited to the results produced by vibrations from the human voice, I became interested in experiments instituted by Dr. Garey, of Baltimore, with the phonograph and, later, the so-called vibrometer. The results of these experiments were reported several times and by different men in this field of work at the meetings of the American Institute of Homeopathy. The *Transactions* contain these reports and may be consulted.

Progress was undoubtedly made in mastering the problem presented by this class of affections, but all were disappointed that still so many cases failed to respond.

Here we will take up our subject as briefly and as succinctly as possible.

It had been my practice to apply the electric current through the cavity of the external ear in many cases of troublesome deafness, where I could demonstrate a decided sclerosis of the membrana tympani with thickening and undoubted ankylosis of the ossicula. In some of these cases, fairly good results were obtained; in others, and I must admit the great majority, absolutely no response was apparent. My experience with the treatment of this class of cases by means of vibratory massage was much the same, namely, that some cases responded and others did not.

I decided to try the experiment of applying vibratory massage by means of sound waves and the electric current simultaneously in some of the more stubborn cases. After worrying with several crude devices, I had my instrument maker reconstruct an ordinary metal-shank spring stethoscope according to my design. The metal shanks leading to the ears were insulated by means of close-fitting rubber tubing, so the patient could handle the instrument readily when it was in use. A post with binding screw was attached to each shank near its base, or where the converging rubber branches are attached. At these points are attached the ends of the conducting cords, which run from a suitable battery. If only one ear is to receive the combined treatment, the conducting cord running to the unused branch of the stethoscope is detached and contact is made with a pad electrode, which is held by the patient at whatever point is selected by the surgeon, usually the region of the Eustachian tube or the neck. The olive-shaped ends, which are applied in the external meatus, are roughened slightly, so that moist absorbent cotton may adhere thereto when the galvanic current is applied. This is necessary, as the sharp burning sensation produced by even mild currents, when the bare metal is in contact, can rarely be borne. The bell-shaped end of the stethoscope is attached to a section of rubber tubing having a lumen about three-quarters of an inch in diameter. This is attached at the other extremity to the instrument in use for producing sound waves, be it vibrometer, organ, or what not. The selected sound is applied at the same time the current decided upon is turned on. Sittings will vary from two minutes to ten and fifteen, according to the character of the case and the effect of the treatment.

It may be asserted that all this is unnecessary, as the electricity might be utilized either before or after the application of massage. My experience proves that the combined forces are far more efficacious. I am not prepared to assert positively in exactly what manner the electricity affects the tissues involved, but I believe it acts primarily to stimulate the circulation of blood in the parts, and secondarily to lessen or remove the effects of the sclerosis and the hypertrophied tissues, by a process of absorption; in other words, aiding materially in restoring the tissues to a more nearly normal condition. While this is going on by reason of the electric applications, the carefully measured and studiously applied sound vibrations are serving to break up adhesions and to further stimulate the free flow of blood to and from the middle ear and its appendages, and in fact often serving even to stimulate a torpid perceptive tract. It is my practice to begin the treatment with an application of a light faradic current, gradually increasing it, even to the extent of the power of endurance in some cases. This is followed by a brief application of the galvanic current, giving from one-half to six or eight milliamperes of current. At times I use one current only, as my experience and study of the case may dictate. When there are much dryness and sclerosis of the tissues, I believe the galvanic current is the more valuable. When there are more moisture and little sclerosis but considerable retraction and rigidity, the faradic current has given me the best results.

My experiments in this field have extended, with some interruptions, over less than ten months, hence I am prepared at this time merely to present this method with a brief relation of some of my results; hoping that others may be influenced to investigate for themselves, and trust-ing that they may achieve much better success than I have, and that this combination of the influence of electricity and scientific vibratory massage upon this often intractable affection may be the means of relieving some sufferers who are otherwise doomed to lifelong misery.

Meyrowitz, of this city, reconstructed my stethoscope, and has the drawings in his possession. I am aware it is somewhat crude as yet, and am convinced that the wisdom and experience of others will be capable of suggesting many improvements in the construction of the instrument and the technique of the applications.

During my experiments, I have as a rule purposely selected the most hopeless cases—those who have been the rounds of specialists and have experienced all that is usually offered for the relief of such troubles. In most instances, these cases had already been treated by means of simple sound massage, with little or no lasting relief. It is my purpose to briefly report a few of these cases from my records, giving both successes and failures a fair presentation.

CASE I. Mrs. A. J. D. Æt. about forty-five years. Has suffered for years from catarrhal deafness; worse right ear; very annoying tinnitus, like wind in a forest. Being a fashionable modiste, she is much annoyed in her business by the dull hearing. Consulted me first in June of 1892; R. E., watch, 4/60; L. E., watch, 6/60. She received the classic line of treatment with considerable improvement of hearing power in left ear, though but very little in right ear. The tinnitus was not appreciably affected. After one month, began application of sound waves by means of the phonograph, with the result that she soon had normal hearing for watch on left side and 12/60 for watch on right side; tinnitus the same. There was still great a deal of confusion for the sound of the human voice in conversation; especially if the person speaking was some distance away, or there were several talking in general conversation. In

May, 1893, after considerable loss of sleep, she became markedly nervous and the hearing power was decidedly reduced: R. E., watch, 6/60; L. E., watch, 35/60. Applications of sound massage by means of the vibrometer had been substituted for those by the phonograph some months before this. Rest and the selected remedies gradually relieved her, and she again improved and passed from under steady treatment in July, 1893. In April, 1894, she reported again with hearing power reduced, being the immediate effect of a severe cold. She continued under treatment until June, 1894, with improvement, though less than had been accomplished before. Confusion for voices and the tinnitus were especially stubborn symptoms. In January, 1895, she again reported with severe cold, and reduced hearing power; was again treated with fair success until March of the same year. In August, 1895, she reported with cold and had taken considerable quinine. R. E., watch, contact; L. E., watch, 3/60, with very loud tinnitus. She improved under general treatment in conjunction with the use of the vibrometer and in December, 1895, the hearing power was R. E., watch, 8/60; L. E., watch, 20/60. At this time we commenced the use of the vibrometer simultaneously with the application of electricity, using about two milliamperes for from five to ten minutes; these treatments were repeated every three days and were continued steadily until April, 1896, at which time there was much less confusion for voices, tinnitus very faint. R. E., watch, 10/60; L. E., watch, 36/60. External ear passage much less dry, and normal cerumen appearing. She has had no treatment since April, and I am informed she continues to be quite comfortable.

CASE II. Mrs. T. B. C. Æt. fifty years. History of long-standing and quite profound deafness from atrophic middle-ear catarrh. She has been under the treatment of several celebrated aurists in different parts of this country and Europe, with absolutely no relief; in fact, she has continued to grow worse. In December, 1895, hearing for watch equaled nil in both ears. A small clock could be heard on very close contact in left ear, not at all in right ear. She was placed immediately under the influence of electricity and vibratory massage, with slight but apparent improvement until she left the city about March 1, 1896, when the clock was heard by left ear at 2 inches distant and by right ear on light contact. This case I have not seen or heard of since. The improvement was not great, but it was more than had been accomplished by other modes of treatment, and the patient was herself encouraged. Family matters compelled her to leave Washington.

CASE III. Mrs. J. A. M. Æt. fifty-four years. History of steady loss of hearing for several years. In October, 1895, hearing for watch, R. E., 3/60; L. E., 1/60; for clock, R. E., 12 inches; L. E., 4 inches. Examination revealed atrophic middle-ear catarrh. Treatment was general, combined with the simple vibrometer applications for about one month, with slight improvement. November 26, 1895, R. E., watch, 7/60; L. E., watch, 6/60. At this time the application of the vibrometer was omitted and the careful application of the galvanic current was substituted. From two to five milliamperes of current applied every third day, sittings lasting from five to ten minutes. On December 10, 1895, R. E., watch, 10/60; L. E., watch, 14/60. At this time the patient was subjected to the combined treatment with electricity and vibrometer, using first a brief application of the galvanic and following with a longer use of the faradic current. This was followed by marked and steady improvement, both in the function and in the physical aspect of the membrana tympani and other tissues in the ear. On March 31, 1896, R. E., watch, 16/60; L. E., watch, 18/60, and clock heard on both sides at 60 inches distant. The patient at this time left the city for the Pacific Coast, and I have not seen or heard of her since.

CASE IV. Mrs. M. W. H. Æt. fifty-eight years. Deaf a long while; much tinnitus; much hyperæsthetic rhinitis; very prone to severe colds; is of a decidedly nervous temperament and is altogether a bad case. On presenting in March, 1894, R. E., clock, 3 inches; L. E., clock, close contact. She received treatment, local and constitutional, and the vibrometer applications until July, 1894, when R. E., clock, 5 inches; L. E., clock, contact. In November, 1894, she reported again for treatment; at this time she was suffering with an acute follicular tonsilitis. After the throat was relieved, she was put upon the same line of treatment, and continued for four months with no improvement in hearing whatever. In December, 1895, she again reported and found some recession of hearing power, R. E., clock, 2 inches; L. E., nil. She was obliged to leave the city at this time and returned March 1 even worse than before; much catarrhal inflammation of the naso-pharynx with ulceration of the nasal mucous membrane, and hearing away down; was much discouraged. On March 7 treatment by means of the electro-vibratory method was instituted and continued with interruptions until July 17 last, when she left the city for the summer. She improved in every way except her hearing. This I cannot conscientiously say was improved to any appreciable or practical degree.

Other cases might be cited, most of them more or less improved, a few not at all affected by the treatment, but I fear I have already laid myself open to the charge of plagiarizing the prosy preacher, and have drawn out my "finally, my brethren," to a tiresome length.

My only object in inflicting this paper on this Society was to attract the attention of those practicing in this field to another possible method of relief for this very prevalent and distressing affection, and to add my mite to the report made here of the varying uses and methods of applying electro-therapy.

Dr. H. C. Houghton: The simple fact is that in dealing with this subject there are so many possibilities, so many factors that come in that lead to mistake of judgment, that it is next to impossible to reach satisfactory data. I think, however, that we all indebted to Dr. King for presenting this matter; I certainly shall renew my experiments with added interest from the fact that another colleague is working along this line. The experiments which I made were suggested to me from the simple fact that, for all the years that I have had anything to do with the subject, I have been convinced that in the faradic current we have the greatest means of restoring the functions of the middle ear and of the pharyngeal muscles. After a long series of experiments with the faradic current, I adopted an alternator and a commutator, so as to get reversal with the galvanic current. After the milliampere came in vogue, I pursued the same method, and gradually came to using the galvanic current with a commutator and following it with the faradic current, a rather high tension current. I had the Barclay Manufacturing Company transform the stethoscope as used by the New York Phonograph Company, putting two metallic tubes in place of the hard rubber tubes, with a support on the side and connecting the current with the two terminals, and that I used in exactly the same manner as Dr. King has described it. As to the results I am not prepared to state ; it is wholly an open question. I shall return to it with added interest now. I was diverted from it, however, by the unsatisfactory results obtained with the vibrometer as contrasted with the phonograph ; but now I shall be very glad to apply the current in connection with the various musical tones of the scale.

I will say, in this connection, though not exactly bearing on the subject of electricity, which is our special theme, that there is a most wonderful and interesting physiological study as regards the effects of various tones (and that is in keeping with Professor Lowenberg's experiments), the physiological effects of tones ; there is an immense field of research that has scarcely been entered upon ; he says that A sharp is practically the same note as B flat, and B flat has remarkable effects in training children, deaf mutes ; and his brochure, which he sent to me, led me to experiment with those tones, and I shall take great pleasure in adding to those notes the vibration under the effect of the faradic current.

Dr. King, of New York : You all know that I know nothing about the treatment of the ear, hardly know the membranes when I see them ; but it seems to me that the instruments do not have the duration of vibration that they should have in developing the vibratory movements of the ear. As I understand, these vibrations are given for two classes of cases : one due to ankylosis of the bones of the ear, increasing their flexibility in vibrations ; and one due perhaps to a lack of stimulus or lack of vibratory movement of the auditory nerve and semi-paralysis or something of the kind. Now, the ear, unlike other instruments, is capable of accommodating itself to all vibrations within a certain limit down to a certain degree or lack of frequency and up to a very high frequency, varying in different individuals; and it seems to me, if you want to get à vibration, the first thing to do is to get a vibration that is capable of the finest gradations from one note on up, so that the ear is capable of accommodating itself to the entire scale. To do this, I should think that the ordinary siren used by scientists for the purpose of measuring the vibratory movements of different tones—that is, the frequency of different notes—would be far better than the instruments used, because there you could get any degree of sound and any degree of rapidity, and, in fact, any note that you wished, with perfect ease. It is important that you should get enough bombardment, that is, force enough in your vibrations, to break up this ankylosis of the middle ear. I believe this can be accomplished through the alternating current. The reason why Dr. King got so much better effects when he used the vibrations with the faradic current is due to the fact that the faradic current heightened the sensibility of the auditory nerve, and when the sensibility of the auditory nerve was so heightened it responded far more readily to the vibrations than it would when it was not so heightened; but I cannot see how the use of the faradic current in that way could have any effect in an ankylosed condition, because there the heightened sensibility would not count, as it would in the case of the nerve. I would like to hear Mr. Osterberg give his opinion about obtaining a frequency of alternation so that it would vary in the frequency, that is, in the number of vibrations necessary to produce a note. If this could be done, you could get the number of vibrations that you wanted—that is, corresponding to the number of vibrations that it took to produce a certain note—and you would get a perfect unison between the vibrations of the machine and the vibrations of the ear. This would have a certain advantage; in the first place, it would give the exalted sensibility, and, another thing, you could increase the bombardment to such force that you could break up any ankylosis that might exist in even severe cases. You could not only break them up but could massage them until they became perfectly flexible. It seems to me that this covers a much larger field than any that has been taken.

Mr. Osterberg: Dr. Houghton's remarks suggested to me the idea which Dr. King has brought out. If I understood him rightly, he says there are particular notes that are more effective with the human ear, in order to incite in it the proper vibrations, than are others. It seems quite natural, therefore, if you want to apply the faradic current in some way, that you might as well get the same frequency with the faradic current that you have in the note itself. Dr. King suggests the use of the siren. The siren is rather a hard instrument to handle, and it might be quite difficult to operate. There is an instrument that can easily be made for one's self, by means of which you can produce the frequency you want by simply comparing with the tuning-fork. With your permission I will make a little sketch.

Take three pieces of hard wood, stretch a string across and attach a weight to it so as to be able to give any tension you please to this string. To the middle of this wire solder a very fine piece of German silver wire and allow it to suspend a certain distance so as to just touch the mercury in a small mercury cup through which a direct current is coming from the same source as this is flowing. Then attach the induced current to the terminals of this. As soon as the current is flowing along there this wire will be attracted. If this little wire meets the mercury, the two currents meet ; the result of which is that they repel, and in that way we set up a vibration. That vibration will be the quicker the tighter the string is pulled ; and if you have a tuning-fork, you can tell from the vibrations of this string exactly what note you have. Of course you cannot use any iron, because that makes you lose your proper tone ; but if you simply take a multiple of turns in this cord and have no iron, you get an exact increase, and you can strike the note you want to strike. This is no more than a box about twelve inches long, and you have a screw attached to increase or decrease the tension. A very hard German silver wire, the same kind of German silver wire that they use for the higher notes on a piano string, will do. You cannot use a violin string, because that does not allow the current to flow through, but a German silver wire answers the purpose perfectly.

Dr. Houghton : We all remember the advice which Sam Weller gave about the "vidders," and I think it will apply about sirens. We had better let that instrument alone. The fact is that a siren is absolutely impracticable in this field. The comments which have just been made by the last speaker are intensely interesting to me. I shall be very glad to avail myself of the suggestions and to have his aid in adjusting the instrument, because I can see that here we have got the perfection of instruments, so far as vibrations are concerned. In an ordinary one-manual or two-manual organ, from the lowest bass note to the highest treble, you have a range, speaking without data, of over three thousand gradations, and you know actually what the vibration is of each note. Approximately, between the two, sharp and flat, of course there is a gradation that you can get only on string instruments, but all these instruments get just what Dr. King wanted; and if we can have an instrument devised so that by thumbscrews and other arrangements we can have just the same number of electrical vibrations as the sound is given in, then we have the perfection of instruments. For over four years I have been looking for an instrument that would give what the English Alexander organ gives. All the reed organs made in this country are made on the suction principle. The Mason & Wright Company have prepared a flat reed force-bellows organ, and it gives a tone which is simply perfection. It is the tone of an ordinary church organ, with the outgoing current and is smooth of vibration. You may apply that to an ordinary stethoscope and you may select any tone you may want in the whole range of ordinary vibration, with just as much exactitude as you can give the algebraic formula for the tone itself.

THE PRESIDENT: There is one other point in Dr. King's criticism which has not yet been touched upon, and that is the emphasis which he laid upon the bombardment that would break up the ankylosis. If Dr. King had tried the bombardment that he can get from this organ, he would think he had about as much bombardment as the patient can stand, after a few minutes. We feel that we have sufficient power in those vibrations; all that is advisable to apply to the delicate mechanism of the ear. And that is a point that occurred to me in Dr. King's paper as to the strength of the current that he used—whether it was not painful to the patient; whether it was not so strong as to create more pain and disagreeable sensation than was advisable, if he was using seven or eight milliamperes.

DR. KING, of Washington: I have used seven or eight, but not for any length of time, with moist cotton wrapped around the roughened end of the stethoscope; they stand fairly well three to five, but two to three has been about the average. There is a great difference in patients. Some patients can take a great deal more under ordinary circumstances, applied in any way, than others, so I have let it go a great deal according to their ability to take it.

THE PRESIDENT: I have used electricity in the ear for a good many years, and my experience has been that two or three milliamperes, or at the outside five, were about as much as the patient wanted to stand on account of the pain; but the subject is one that is very interesting to all of us working on this special line, and I think Dr. King's results have been such as to warrant our continuing.

DR. HOUGHTON: I will say that I shall be very glad to show this organ at my office to anyone interested.

There is one point on which we none of us have touched that, it seems to me, is of the greatest importance. We are speaking so constantly of the middle ear. The best results in the treatment of adenoids that have come under my observation were produced by treating the middle ear by way of the fauces with an electrode applied so that the current took in the fauces, the muscles, the area around the Eustachian tube, so as to take in the whole mechanism; and I think when we study and apply our current simply from the meatus to the occiput or the exit of the trifacial, as the case may be, we are not covering the whole physiological field.

Dr. King, of New York: I am aware that any text-book of physics will give us the vibrations, but I am not sure that the siren would not work. I have not seen Dr. Houghton's organ; the only one I have seen is the vibrometer. I should like to ask Dr. Houghton if the siren has ever been used.

Dr. Houghton: I never have used it; I do not believe I shall. Seeing it once would be sufficient. Anyone who knows the effect of this siren knows that the quality of tone, the absolute absence of over tones, is such that no mortal would ever want to listen to it. It is simply an absolutely impracticable instrument. It might be used in political times for a screamer, but it is absolutely impracticable for this purpose. You know the number of vibrations, but they are so void of musical quality that I do not think the patient would ever come in the office the second time.

The President: Perhaps one reason why we have not experimented more with the siren is because to get an instrument that is of any value to experiment with is extremely expensive; and from my investigations a few years ago when I had this in mind I found two perhaps in the city; one was in Columbia College. That was the principal reason for not using it, the great expense of experimenting with it.

Dr. King, of Washington: I want to thank the members who have so kindly discussed the subject and have offered me so many suggestions. The object of the paper has been attained. I wanted simply to bring out discussion and learn what I did not know myself.

The President: I think we have covered all the papers whose authors are present. There are a number of other interesting papers which have been sent in to the Secretary. I will ask him to read the one on Faradism by Dr. Townsend.

FARADISM IN ATROPHIC RHINITIS.

BY DR. IRVING TOWNSEND, NEW YORK.

In a paper read before this Society in 1893, by Dr. John B. Garrison, he strongly urged the employment of the faradic current as a useful adjunct to the treatment of atrophic rhinitis, and reported good results from its use in a few cases during the year preceding. He was prepared only to report *progress* in the treatment of his cases, as sufficient time had not elapsed to claim permanent cures. I had previously used this agent in two or three cases for a short time without any particular effect, and did not feel justified in urging the patients to continue the treatment with the uncertainty of achieving any permanent results. Becoming satisfied, however, that the use of the faradic current in these cases was based on sound principles, I resolved to continue its employment with the hope of better results. During the past two and a half years, I have treated fourteen cases for from three months to one year, and have used the current in other cases, either at infrequent intervals or for a shorter time. In these latter it is impossible to say what result was obtained.

The pathology of atrophic rhinitis is not a settled question. It was formerly considered as a later stage of the hypertrophic process. Bosworth considers it to be the result of purulent rhinitis of childhood. Some investigators, from recent research, claim to have isolated a specific bacillus peculiar to this disease and, in view of this, assert it to be a specific disease due to infection. This latter theory is still unproved.

Whatever theory of its origin we may accept, it is very sure that it is characterized by certain retrograde tissue metamorphoses due to deficient nutrition of the nasal mucous membrane and underlying structures. This fact makes it certain that any means employed for its cure must be directed toward increasing the blood supply and improving the nutrition of the parts affected. It is for this purpose that faradism is used. Its use, however, does not supplant other measures but supplements them.

Certain diseases, as scrofula, syphilis, and tuberculosis, probably are predisposing causes. Anatomical peculiarities, as deflected septa and large nasal cavities, may favor its development. The diagnosis is easy and the symptoms characteristic. The sequence of events in its development may be stated as follows: Diminished blood supply and activity of the muciparous glands; an abnormal secretion, deficient in the watery elements; dryness and retention of secretions; atrophy of mucous membrane and submucous tissue; enlarged nasal cavities; formation of crusts, and fetor. The prognosis is not good under ordinary methods of treatment, though in young subjects under favorable conditions a cure, or at least relief from distressing symptoms, may be obtained.

The number of cases treated is too few to enable me to speak authoritatively on this subject, but may serve to encourage us in persisting in the use of this agent as a help in the treatment of these cases. Of the fourteen cases treated, only eight received treatment regularly two or three times a week; the other six cases were not regular in their attendance during a sufficient period of time to receive the full benefit of the treatment. Every case received in addition to the electricity a cleansing spray once or twice daily of Seiler's solution, or dilute borolyptol, followed by local applications of ichthyol, one part to eight of albolene, or eucalyptol and albolene, five per cent. solution.

The current was applied at first by means of a steel electrode covered with a layer of absorbent cotton and later with a platinum electrode, flattened and about 1½ inch in length, and covered with the same material, inserted into the nasal cavity; and the other electrode, a sponge-covered disk, applied to the forehead. Mild currents were used, the sensations of the patient serving as a guide, and, when any discomfort was felt, the strength of the current was reduced to a point of comfortable toleration. The durations of treatments lasted from three to ten minutes, during which time the intranasal electrode was applied as far as possible to the whole surface of the mucous membrane. The immediate result was to produce a flow of watery mucus and a relief of the sensation of dryness which causes so much discomfort to the patient. This stimulant effect lasts for several hours, but by the second day the dryness again becomes noticeable and another treatment is required.

Daily treatment is best whenever possible at the beginning, or at least on alternate days it should be insisted upon for the first month. After this, two or three treatments a week will usually suffice, and as the case progresses the intervals may be lengthened. The degree of atrophy existing must serve as a guide to the duration of treatment, and in this respect every case is a law unto itself. In mild cases, six months may be enough to establish a cure, and in other cases the treatment should be persisted in for a year or longer. It is wise to advise the patient at the beginning of the treatment of the nature of the disease and the length of time that will be required to accomplish satisfactory results, so that he may not be disappointed and give up treatment before any material progress has been made. Only such cases as are willing to undergo treatment for a prolonged period are worthy of a serious attempt at a cure.

In every case where faradism has been employed for three months or longer, I have seen beneficial results from its use, and in four of the cases treated the improvement has been such that I feel justified in considering them cured, both from the relief of symptoms and the appearance of the nose on examination. The other four cases who were faithful in carrying out the treatment are much improved, and suffer little or no inconvenience at the present time. In these patients the nasal mucous membrane is in a fairly healthy condition, though the submucous tissue has not been to any extent reformed, and the cavities are large. The other six cases have received some benefit from the treatment, and four of these report occasionally for treatment when the symptoms become troublesome.

While the beneficial effect of faradism in these cases has been such as to justify its continued use, it is only proper to state that its efficiency probably depends wholly on its stimulating properties. The muciparous glands that have been destroyed in the sclerotic process cannot be restored to functional activity, nor can the epithelium that has degenerated from the columnar ciliated to the squamous variety be reconstructed.

In using the term "cure," it should be understood as the restoration of the mucous membrane to its functional activity, and the subsidence of all distressing symptoms; and not the regeneration of any tissue that has been entirely destroyed by the atrophic process. This latter result is not to be expected from any kind of treatment, hence the word should be used in a restricted sense, to signify a disappearance of symptoms, and not the complete restoration of all the tissues involved to a perfectly normal histological structure. This is precisely the basis on which "cures" of all chronic diseases are estimated, and I offer no apology for the use of the word.

I regret that my report embodies such a limited number of cases, but every rhinologist knows the difficulty of persuading these patients to undertake and continue a prolonged course of treatment, with the uncertain hope of permanent good results. It is my opinion that faradism is a most useful aid in the treatment of atrophic rhinitis, and I hope that future results, obtained from its use by others, will verify my own experience.

Dr. Palmer : About two years and a half ago I made some experiments with the electrical treatment in several of our hospital cases but I used principally the galvanic current ; and I gave it up for the reason that it seems to take such a length of time to give each treatment with the present electrodes. Then I made two, but each of them was unsuccessful. The first one was made in this way : there were three little flat pieces of metal, which I covered with cotton to be soaked in water. Of course they did not come in contact with the membranes in between the turbinateds and the outer wall of the pharynx, and afforded no benefit by treatment to the membranes. Then I had a little rubber bag made which I could fill by a small tube, and outside of that were several small pieces of wire, and that covered by a thin piece of chamois. I forget what we did substitute for that chamois which will soak up water and yet not be quite so thick. This I introduced into the pharynx, and distended the bag with water so that it conformed itself to the shape of the nares ; but the difficulty in that was that in introducing it we would make an outlet through the bag so that it would not hold water. I found I used up five or six of those in a very short time. I think that the application of electricity to the nares is going to be successful if we can apply it to the majority of the membranes. I use it on the membranes to which I can make the application ; but there is so large an area of membranes that we cannot get at with our present electrodes that we cannot benefit them.

Dr. J. B. Garrison : I might say, as far as my treatment of these cases is concerned, that I have had very moderate success ; mainly, I think, from the reason that it has been impossible to get the patients to continue for any great length of time. I have had a few cases in which there has been a very fair success, and in some quite serious cases have had marked success where they have kept on for any fixed length of time ; but usually they would drop off and come once a week and once in two weeks ; so that the treatment was no great success. I believe, if the treatment were continued for any length of time, we should get very marked results.

TESLA CURRENTS.

BY F. F. STRONG, M. D., BOSTON.

As the writer is unable to be present, he has selected the study of induced electricity as a subject for the following brief article—the consideration of what is, perhaps, the most important discovery in connection with electric induction that has been made in recent years: viz., the so-called high-frequency currents of Tesla. These currents differ greatly from any form of electricity yet studied; being chiefly remarkable for their enormous electromotive force of a million volts or more, and from the fact that the direction of the current is reversed many thousands of times in the course of a second. The wonderful nature of these currents may be seen by enumerating a few of their properties. If the terminals of a Tesla coil be placed a few inches apart a terrific torrent of sparks passes between them, attended by a sound resembling a volley of musketry, while, at the same time, brilliant brush discharges of purple light project in every direction from the exposed surface of the terminals. The discharge is similar to that given by a large Rhumkorff coil, but the number and intensity of the sparks are much in excess of the latter. A six-inch spark from an ordinary induction coil would, if passed through the human body, be attended with very serious, if not fatal, results. The Tesla current, on the contrary, may be taken through the system with impunity, the shock being really less than that given by the average small medical coil, while the sensation is of a much pleasanter nature. By attaching an ordinary incandescent lamp to a stout wire and presenting the end of the latter to one terminal of the Tesla coil—the other being in connection with the body of the experimenter—the lamp will be lighted; the current passing first through the body and then through the lamp.

Another curious property of the Tesla current is its behavior toward conductors. In our ordinary forms of electricity we convey the current on a metallic circuit which is insulated by a non-conductor—such as rubber, or a layer of air, as in the case of telegraph and telephone circuits. The Tesla current, on the contrary, will leap several inches of air, rather than make the journey around a closed circuit of wire. Tesla suggests that we might conduct the current on a stream of illuminating gas, the metal pipe in this case answering as the insulating material.

This current has not been used by the medical profession except in connection with the production of " X-rays."

NOTES BY THE WAYSIDE.

BY M. BONNER FLINN, M. D., WORCESTER, MASS.

Nervous dyspepsia is one of the most intractable diseases known.

It is seldom that you can persuade your patient to follow out a regular course of dietetic abstinence for a sufficient length of time to allow the nerves of digestion to recuperate; as soon as relieved, they return to their former habits of eating.

Digestion is much impaired by mental, business, or social taxation, and when advice and drugs fail, and dietetic rules are ignored, electricity comes to the front.

But three-fifths of your patients, when relieved by this method, will not have the moral courage to continue long enough, after relief has been attained, to perfect a cure.

My experience proves that in most cases the faradic current (long wire) is the most effective; though in other cases I may have to combine the primary current with it; and, still in others, use the primary alone. I apply the cathode at fifth dorsal, stabile, passing the anode, labile, over liver, stomach, and bowels, with slow interruptions; strength of current, sufficient to produce slight muscular contractions; using hand electrode; séance to last from twenty to thirty minutes on alternate days.

Where there are constipation and nausea, with pains in various parts of the body, I then make use of the primary coil; anode at sacrum, stabile cathode over the bowels and stomach, labile about twenty minutes; I also apply the cathode to first dorsal; stabile, five minutes, anode on bowels, stabile.

At times good results are produced by placing one pole on either side of the abdomen, with a moderately strong current labile.

This treatment, by its tonic influence, will improve the nutrition of the spinal cord and nervous system, and stimulate assimulation. Instance:

E. J. B.--A contractor and builder, aged thirty, very sensitive and nervous, complained of severe pains in cervical vertebræ, pains in stomach; meals irregular, appetite poor, bowels costive, severe attacks of headache, emesis occasionally; pains in different parts of the body, insomnia, losing flesh; he had tried various treatments, with but little improvement.

I undertook his case and treated with the faradic current; the pains soon vanished, he began to sleep better, liver and bowels became more active, and at the end of two months he felt like a new man.

Periarthritis and Chronic Synovitis.—I have had a number of cases of shoulder joints to treat, during the past two years, that have been injured by falls or in carriage accidents.

In the majority of cases, I have been most successful in the use of the electrical currents.

The plan of treatment I have followed has been to place cathode in axilla; anode, labile over the shoulder joint and down the forearm. By this means you can pass the current through the joint in all directions.

Butler.—Aged sixty-eight, shoulder injured by being thrown from his carriage six months ago. Pain, stiffness, articular motion limited, could not lift arm to level of clavicle, could not carry the arm to the back, crepitus on motion.

He had tried all the usual remedies,—blisters, liniments, massage,—but kept growing worse. At last was directed to me for treatment.

I applied cathode to second dorsal; with sponge electrode attached to anode, passed the current around the muscles and joint, using the faradic current, pleasantly strong, about twenty minutes. After a week's treatment, daily, he felt better, but found no improvement in motion of joint. I then treated him by combining primary and faradic coils, cathode in axilla, anode, sponge electrode, over and about the joint and muscles of the forearm and shoulder, thirty minutes, alternate days. There was a gradual improvement, and at the end of three weeks he had full use of arm motion and the crepitus was gone; case discharged, cured.

(Apostoli, as shown by an article read before this society last year, has had wonderful success in the treatment of Nervous Dyspepsia in using the + galvanic, on the vagus. V. *Transactions* for 1895.)

ELECTRICITY IN CERTAIN OBSCURE DISEASES OF THE BRAIN.

BY CHARLES PORTER HART, M. D., WYOMING, O.

In the very interesting and instructive remarks of Dr. Bonnefin on the treatment of cerebral lesions by electricity, as reported in the official bulletin of the French Society of Electrotherapie for November, 1895, I was much struck with his statement concerning the effects attributed by Remak and Hiffelsheim to their several methods of treatment in certain brain affections. Without calling in question the truth of the statement referred to, namely, that "The results obtained by these two physicians have not been confirmed by experience," I have thought that it might not be wholly uninteresting to this society for me to give a portion of my own experience in the same line of practice, particularly as regards the application of electricity to certain obscure conditions of the brain, which latter, whether functional or not, I have found to produce in various parts of the patient's system more or less physical suffering and derangement.

The phenomena resulting from the cerebral conditions referred to may be either direct or reflex, local or general, acute, subacute, or chronic, but the distinguishing characteristic seems to be that in all cases they are in some way connected with, or dependent on, some trouble within the cranium—as evidenced by the good effects, often amounting to permanent cures, of mild electrical currents applied perseveringly through the head. I have called these cases *obscure head troubles*, because in many instances even when, as is usually the case, there are no manifest head symptoms (except it be a slight degree of anæmia, hyperæmia, vertigo, or cephalalgia), the suffering or derangement, however remote, circumscribed, or diffused, is found to yield only to mild currents (say from 3 to 5 ma., or at most 5 to 10 ma.) of *cerebral galvanization.*

As these cases can be best illustrated by examples, I will give a few selected ones from my case-book.

CASE I. Miss E., music-teacher, aged twenty-two years, blonde, of medium height, delicate constitution, appetite capricious, neurotic temperament. Her general health has always been fairly good, although she has never been very regular in her courses. The menses made their first appearance at the age of thirteen years, since which time they have reappeared at intervals varying from 3 to 6 weeks, while occasionally 9 or 10 weeks have intervened between them. They are seldom painful, generally profuse, but not debilitating. No head symptoms to attract attention except at the menstrual period, when there was sometimes slight mental confusion but no vertigo. Fearing bad results, the mother had employed during the last seven or eight years, one after the other, a number of eminent physicians to treat the case, none of whom, however, had succeeded in even ameliorating the condition. Several of them had made use of different forms of electricity, but none of them, so far as I could learn, had thought of applying the remedy to the head.

Regarding the case as one of a tonic or passive uterine congestion, I first applied the faradic current, positive pole, insulated, to the os, negative over the fundus uteri, séances each lasting from ten to fifteen minutes daily. Experiencing no good effects from repeated trials, I next made trial of both local and general galvanization but with no better result. At last, after nearly a year of methodical but fruitless effort, as a *dernier ressort*, I ventured to apply a mild galvanic current through the head twice a week, each séance lasting about ten minutes. As the general health had become somewhat impaired during the previous treatments, I was surprised to find that it now began to improve, and this encouraged me to continue the cerebral treatment with great regularity. Finally, after some forty or more applications of the kind had been made, covering a period of nearly six months, the menses became normal, both as to time and quantity; the general health, also, was fully restored.

CASE II. Mrs. H., aged sixty-five years, married, three children, marked embonpoint, scrofulous constitution, the tuberculous taint showing itself only in childhood, after which the general health remained good up to the age of sixty-one years. Four years ago she suffered an attack of "la grippe," gastric form, with high fever, protracted vomiting, some abdominal neuralgia, but less than the usual amount of cerebro-spinal suffering. These symptoms were followed by general neurasthenia of a mild character, accompanied by more or less cardiac palpitation. This condition was gradually overcome by methodical galvanization of the spine, applied tri-weekly, for a period of fourteen weeks. After this her health remained good until last September, when new and more serious symptoms appeared. Her lower extremities suddenly became anæsthetic, lowered in temperature, and slightly paretic, but without R. D. This condition became gradually aggravated, so that in the course of about five months, notwithstanding the methodical use of both the interrupted and constant currents to the spine and limbs, the latter became so numb, heavy, and unmanageable as to render them almost useless for purposes of locomotion. After several weeks' electrical treatment of the spine and limbs without perceptible benefit, I bethought me of trying the cerebral treatment, and much to my surprise the patient's limbs began to improve; seeing which, I abandoned all other treatment, and confined myself to daily galvanizations of the head. Only mild currents, 5 to 8 and 10 ma., were employed, stabile; each séance lasting ten minutes. Only about six weeks of the "cerebral treatment" was required to restore the impaired functions of the limbs.

CASE III. This is a case somewhat resembling the preceding. Mrs. S., a minister's wife, aged about forty years, experienced a severe attack of facial erysipelas, which extended over the entire scalp. The patient, however, made a good recovery; very slight cerebral irritation supervening during the course of the disease. Eight months afterward the right arm suddenly became paretic, gradually growing worse in spite of stimulating embrocations, massage, and even local faradization. At this stage of the trouble I was called to treat the patient. Galvanization was first tried, but without any apparent benefit, although faithfully applied for several weeks. At last, thinking that the brain may have suffered somewhat from the previous attack of erysipelas, I resorted to cerebral galvanization, and after a few séances I had the pleasure of witnessing a marked improvement in the power and use of the affected arm; in short, full recovery took place within a month after the galvano-electropeutic treatment was applied to the head.

CASE IV. Mrs. B., aged forty-two years, married, three children, neurotic temperature, general health good. While carrying a heavy child in her arms she accidentally stumbled and fell, laming her right knee, which soon became red, swollen, and painful. Rest, cooling lotions, wet cups, and finally blisters were tried, one after the other; the treatment extending over a period of nearly twenty months' with very little improvement, the patient being able to get around only upon crutches. I diagnosed the case as one of *hysterical knee*, and applied to it daily anoidal galvanization. These applications proving wholly inefficient, even after forty-four sittings, each of ten to fifteen minutes duration, I endeavored to diminish the reflex irritability by applying the An, stabile, to the spine and certain sensitive points in its vicinity, but with no better success than before. At last, after more than a year of this fruitless and variously modified electrical treatment, and when almost despairing of final success, it occurred to me to try the effect of "cerebral" treatment in the case, when lo! the very first galvanization of the head produced a markedly happy effect upon the knee! Hysteria, indeed! Three daily séances of the kind just mentioned proved permanently curative, and the patient threw away her crutches. *Eureka!*

Were these cases altogether exceptional, or have other members of the society had similar experiences?

CONCLUSIONS.

1. The brain is occasionally the seat of abnormal conditions of an obscure nature, which sometimes manifest

themselves only in remote and distantly related parts of the body.

2. The morbid phenomena in this class of cases are probably of a purely sympathetic character, arising from, or depending on, functional disturbances within the brain.

3. These disturbances may be of a circulatory, neurotic, or molecular character, metabolic but not atrophic; hence most amenable to the catalytic action of the galvanic current.

4. Experience shows that the mild stabile action of the anode usually gives the best results, with daily, tri-weekly, or semi-weekly sittings, according to the degree of chronicity, or of nervous irritability; the séances having a duration of from ten to fifteen minutes each.

5. Cases of this sort sometimes require many months' treatment in order to effect permanent cures, though even in these cases there is generally more or less amelioration of the symptoms from the beginning of the cerebral treatment; in fact, the amelioration itself is often the only tangible point in the diagnosis, and consequently the only criterion in many cases on which to predicate this form of treatment.

6. Manifest head symptoms—such as vertigo, mental confusion, etc.—are not always absent, in which case, of course, the diagnosis is most easily made, but I have generally obtained the best results in cases where there were no head symptoms sufficiently pronounced to attract attention.

7. Some cases I have met with which appear to be of a cerebro-spinal character. These cases generally yield to a mild stabile current applied to the base of the brain.

Dr. Frazer: It is to be regretted that the doctor does not state how much current he uses, or its direction, in many of the cases. The size, shape, and material of the electrodes would also be of interest.

ALTERNATING CURRENTS AND TRANSFORMERS.

BY RALPH W. POPE AND TOWNSEND WOLCOTT.

The commercial employment of high tension alternating currents with transformers for reducing the tension at the point of consumption began about ten years ago. The earliest machine which generated electric current by magneto-electric induction produced alternating currents, and even in the individual coils of the modern continuous current dynamo the current is still alternating. The only machines which generate continuous currents are known as uni-polar machines, and are suited for only very low electromotive forces.

The necessity for continuous currents for some purposes resulted in the invention of a mechanical device for rectifying the alternating currents or turning them all in one direction in the outside circuit. This device has been called a commutator, although the name had already been used for another appliance intended for a different, but closely associated purpose. The older device is now sometimes called a pole changer. The flow of the current is in rapidly following waves of reverse polarity, alternating positive and negative. Currents produced by induction are always of this character, thus differing materially from the continuous flow from a voltaic cell.

For a time the improvements in dynamo machinery were almost entirely in the direction of continuous current machines, which were brought to a high degree of perfection. It would then seem to the uninitiated that the partial reversion to alternating currents was a retrograde step, but there are certain advantages inherent in the alternating current which have only been developed in the latest engineering, so that we have not by any means taken a backward step but have developed a new practice in alternating currents, which has brought them not only abreast of continuous currents, but put them in some respect far in the lead.

In the distribution of electric power from a central station to distant points, there is a condition encountered that is completely analogous to the problem of steam or water power distribution through pipes. The power of water does not depend on the quantity of water alone, but also on the head of pressure at which the water is delivered. Therefore the greater the pressure in the pipes the more power the pipes will transmit with a given quantity of water, and moreover the more water the pipes will transmit with a given percentage loss of head or pressure by the friction on the pipes. In distributing electric power the same principle applies: the higher the pressure, the more current will go through the wire with a given percentage of drop (as the same percentage of the drop is a greater actual drop), and also a given quantity of current will convey more power. It will be seen from this that when it is necessary to transmit power to a distance it is desirable to use as high a voltage as practicable.

When the distance is very great, it is especially desirable to have the voltage very high so far as economy of transmission is concerned, but on the other hand it is very necessary where wires are brought into the house and other buildings, to reduce the voltage to a degree that is in no wise dangerous to life, in case of accidental shocks. Moreover for incandescent lighting the voltage must be that required by the lamps, which is usually quite small as compared with the line voltage. It is here that the alternating current is superior to the continuous, for in the latter the commutator is the weak point. It is not practicable to commutate currents, especially large ones, above a comparatively low voltage on account of fusing the brushes and commutator. The alternating current requiring no commutator, may be generated at much higher voltages, but more important than this, the alternating current may be converted from one voltage to another with the utmost facility, and with very little loss of energy. In an alternating current generator, the poles are arranged in multiples of two, pointing inward to the center, consequently there are an equal number of north and south poles.

As the conductor revolves in front of these poles, the alternating current waves are generated, and the rapidity with which these reversals occur is known as the frequency.

It is essential that the rotating wires pass two unlike poles to produce a rise and fall of current and its reversal. This is called a period, and is governed by the number of pairs of poles and the speed of the generator. The maximum electrical effect does not prevail at the first impulse of electromotive force. There is at the outset a retarding influence due to either the resistance or self-induction. This interval of time is known as the difference in phase. The alternating current converter or transformer is somewhat like the Ruhmkorff coil, with which all physicians are familiar. The chief points of difference are that the Ruhmkorff coil has a straight iron core and a circuit breaker in the primary circuit, while the transformer has usually a core that has no free ends, but forms a close magnetic circuit either circular, square, or some other form, and further there is no circuit breaker. The action of the transformer is based on the principle of induction. This property of electricity is peculiar because of the impossibility of insulating it or in any way cutting off its effects. Through this inductive effect, the alternate current transformer becomes a possibility, and upon this depends the economy and flexibility of the alternating system. There are two separate windings, one for the primary, and one for the secondary current. The primary is usually wound with finer wire than the secondary. These windings are carefully insulated from each other so that no currents should pass from one to another. The only connection between the two is purely inductive. That is to say when the current in the primary rises or falls it induces a current in the secondary. The primary current, being an alternating one, is continually rising and falling, so that it is continually inducing a current in the secondary, which is also an alternating current. The transformer is most frequently used to transform the high tension line current to a low tension suitable for lights or motors, but on long lines where a very high tension is used, higher than it is practicable to generate direct, other transformers are used to increase the dynamo voltage to the value of the line current. These are called step-up transformers. They are not a different kind, but are used differently. The ratio of the electromotive forces of primary and secondary is the same as the ratio of their respective windings. If a transformer was made with an equal number of windings on both coils, the primary and secondary currents would have the same voltage, and there would be no object in transforming. If the ratio of the windings was ten to one, then by connecting the ten coil with the line or primary the other coil would give one-tenth of the line voltage. If the line voltage was one thousand the secondary voltage would be one hundred, a pressure suitable for incandescent lights. If the primary current was led into the one coil the voltage at the ten coil would be correspondingly raised.

The only limit to the voltage on the line with alternating currents is the insulation. A current of ten thousand volts has been used in England for a number of years with perfect satisfaction, and double that voltage has been tried at Niagara. The extremely high voltages are only on the line proper, as step-up transformers are used at the generators, so that it is not necessary to touch anything connected with the line when the current is on. There is not even a switch in the line circuit, for when it is desired to stop the line current the dynamo circuit is opened.

The alternating current is known in electro-therapeutics as the faradic current. But that name also includes the discharge from the Ruhmkorff coil which is under same circumstances all in one direction. The reason for this is that the Ruhmkorff coil is arranged to give a high secondary electromotive force upon the rupture of the primary circuit. The secondary electromotive force upon making the circuit is correspondingly reduced, and when the secondary current has to jump an air gap as it frequently does, the "make" current does not jump at all, and therefore the "break" current is the only one that passes, and that consists of a succession of disconnected impulses, but all in one direction. Usually, however, the secondary discharge from a Ruhmkorff coil, as used in medicine, is an alternating current, but with the impulses in the two directions of a different quality. On the "break" they are of short duration and high electromotive force, and on the "make" they are of longer duration and lower electromotive force. The alternating current of ordinary frequency differs somewhat in its physiological effects from the direct current, but strange to say not so much as it does from alternating currents of exceedingly high frequency. The experiments of Mr. Tesla and others with this class of currents are probably more or less familiar to all here present. Electricity is used in medicine for several purposes where the physiological action of the current is not concerned, and for these purposes it is for the most part immaterial whether it be alternating or direct. The small incandescent lamps used in surgery work equally well with either kind of current provided the voltage of electromotive force is right, and the same may be said of electro-cautery. It is somewhat more difficult to procure good alternating than good continuous current motors, of a size suitable for medical use, but otherwise there is no difficulty encountered in the use of alternating current for motive power.

MR. OSTERBERG: The paper which was presented by Messrs. Pope and Wolcott is one of general interest, not only to the physician but to practically everybody ; nowadays when there is so much electricity in and under our streets and in our buildings, everybody ought to be more or less familiar with the running of circuits. It is especially of interest to the physician, as the time is coming when he will be forced to dispense with the primary battery. A few years ago a physician had quite an outfit with ten or twelve cells, but nowadays he uses forty, sixty, and eighty cells in his rooms, which become quite a nuisance to the wife of the doctor, because of the dirt, and they are not pleasing things to have around. Mr. Edison expressed his opinion once in rather a sharp way. He said he did not like batteries because the blamed things are wet. Now, that is a very good way of expressing it. When we come to so considerable an amount of voltage as is obtained by forty or sixty cells (and we want voltage, if we are to get a considerable amount of current), it is preferable to use the current as it comes from the street. It might be well, having arrived at that point, to speak of some details in connection with such application. A physician allows the street current to go through a few lamps and then shunts the current which he wants to apply to his patient from one or two incandescent lamps. There is considerable danger connected with this kind of procedure, as I will presently point out to you. Assume, for example, that one of the filaments in the incandescent lamp across which the current is shunted should break : then the patient will get the current which would otherwise flow through the lamp. Although this would be a point of danger in but few cases, it might have serious consequences in some. But take a more dangerous case, such as the crossing of a high-tension current on the street : then such an accident would, of course, blow the fuses and also break the filaments of all the lamps. But it should be remembered that in many cases the part of the body to which the electric current is applied is more sensitive than the fuses or incandescent lamp filaments ; therefore, those parts would be destroyed immediately. These things must be guarded against, especially in small places. By a small armature and an additional commutator put on to an electric motor, we can get whatever voltage we want ; it is merely a matter of winding the armature ; and in that way we produce an instrument which is absolutely safe, which is easily handled, which is thoroughly clean, which occupies very little space, and which cannot possibly give any trouble whatever under any circumstances : furthermore, it enables you to get along without using a great many cells, and you get whatever pressure you want.

Mr. Wolcott mentioned the Tesla current. There are a great many points about the Tesla current, one being that we are not dealing with an alternating current or a direct current, but with the oscillatory. There are an enormous number of oscillations, and some of the experiments are perfectly easy, certainly from the engineering point of view.

Dr. Frazer has called your attention to an experiment of D'Arsonval's, which is very suggestive indeed. The current is taken from the static machine and put through two Leyden jars. At the top of the Leyden jars two electrodes are brought close together, and a lamp filament is shunted with a coarse helix connecting the outer coats of the jar. The filament can be lighted up while the spark is jumping across the two terminals at the top of the jar. Now, from an engineering point of view that appears to be impossible, and it is only conceivable if we have oscillatory discharges. The oscillatory current ought to be considered independent of all the other currents. In the first place, we can send the oscillatory discharge through our own bodies without feeling it; in other words, it appears to go along the outside just as a very high tension alternating current goes along the outside of the wires.

The experiment that Dr. Frazer spoke of I should like to see repeated. There is great opportunity for study in that field. The unit of capacity has not been spoken of this afternoon, and induction might be taken hold of by the physicians. If they will take hold of those two subjects, they will find a current with which they can deal successfully, and which will do a great deal of good. One of the direct applications of the oscillatory current is the Crookes tube; that is, of course, one of the physical applications; I do not know anything about the medical applications.

DR. W. H. KING, of New York: I would like to ask Mr. Osterberg a question. As I understand him, he says that the Tesla current is simply an oscillatory current the same as the induced current through the Leyden jars, which is simply an alternating current; the unbound current running with so much less intensity than the bound current that it produces an alternating discharge, but is only felt in one direction: I would like to ask if the Tesla current is the same as that.

MR. OSTERBERG: No, I do not understand the Tesla current in that way. The Tesla current discharges an enormous number of times in comparison with the ordinary faradic discharge. It may appear to you from the peculiar crack that the spark went across just once and that was the end of it. As matter of fact, it was demonstrated in 1887 that the number of times that this spark goes back and forth is one billion times per second.

DR. W. H. KING, of New York: That is in the static current?

MR. OSTERBERG: With a static machine or with the Ruhmkorff coil. With the induction coil you can produce the same thing, but it is not the ordinary faradic current, for you have there a very low frequency compared with the enormous frequency in the oscillatory discharge. The way Tesla does is by taking a separate transformer. With a battery of Leyden jars you can get the oscillations between the terminals of the Leyden jars. It is a decidedly different current from the ordinary faradic.

Dr. W. H. King: Will it produce the same curve?

Mr. Osterberg: It may be just like it and it may be somewhat different when there is so much more frequency.

Mr. Wolcott: Strictly speaking, the difference between an oscillatory current and an alternating current is that in an oscillatory current the electromotive force begins at a maximum value, and gradually dies out, while in an alternating current the electromotive force is constant. Otherwise they are just the same. But the Tesla current has an enormously high frequency up in the millions or thousands of millions where the others are in the hundreds. That is the chief difference, but, strictly speaking, when we say oscillatory we mean where the current is dying out. In the discharge from a Leyden jar through a low resistance the current will oscillate a great many times, just as when you swing a pendulum in the air it will oscillate back and forth a great many times before it comes to a rest; but if that pendulum was swung in molasses, it would probably stop the first time or perhaps the second or third swing; and similarly, if you discharge a Leyden jar through a very high resistance there may be no oscillations at all; if you discharge it through a wet string the resistance is so great that the energy is all dissipated in the first impulse. By introducing the required resistance you make the frequency anything you please.

Dr. W. H. King, of New York: I would like to ask the question: What is the difference in the alternating character between the induced static—the discharge of Leyden jars—and that of a high tension coil, and do we get any more of the alternating current in one than in the other?

Mr. Wolcott: If you discharge that Ruhmkorff coil through an ordinary resistance, you get the current illustrated by the ordinary curve of the faradic current alternating in character; on the other hand, you may discharge the spark through an air gap and get an oscillatory current where each one of these impulses will be made up of a great many oscillations.

Dr. Gardner, of Washington: I would like to ask Mr. Osterberg one question: Speaking of the electric light current in a physician's office, I have in the basement of my office perhaps eighty or one hundred cells, and I have a switch with the Bailey rheostat. Last winter when I wished to get a current above a hundred milliamperes, I used the electric light current. One day I wanted to get a current of 150 milliamperes; the patient was in the chair; I could get no current and turned it into the cells in the basement. As I did so, the fuse was burned out; there was a spot burned out as large as my hand. What would have happened to the patient if I had not turned it off just at that instant? I called up the electric light company but could not find out anything from them; outside I found out that a wire with about eight hundred volts caused the damage.

MR. OSTERBERG: These accidents are apt to happen, and if you have only one in five thousand cases, it is one that physicians ought to guard against. You should use a motor dynamo, then the insulation will be sufficient to withstand a voltage of several thousand between the motor and dynamo armatures. I know, for example, that the Crocker-Wheeler motor dynamos are put to such tests in their factory.

LIEUTENANT PATTEN: I think Mr. Osterberg has not been entirely understood about the motor dynamo. The fact is it is not entirely a question of insulation if it is rightly made. In the first place, instead of using such a machine as has been so far considered, that is an ordinary double-wound armature, it is a very simple matter to have them so entirely distinct that no voltage can jump from one to the other. In the first place, there should be a double machine, that is, a one thousand or a five thousand volt machine, which is nothing more than a motor on the street circuit. It is connected by a separate spindle to another armature of low voltage, and that is a pure generator or dynamo driven by this first. Now, whatever happens in the way of intense voltage to the first, it can have nothing whatever to do with the second or generating dynamo, being entirely separate and distinct. The primary safe construction to meet all those cases would be to have independent machines on a single basis, so that there is absolutely no connection between them, if you want to be absolutely certain there is no risk. In that way there is no danger.

MR. WOLCOTT: If improperly installed a line current is always of very high tension. If the primary or line current becomes short-connected with the ground, you get high tension where a person may receive a shock from it; and it is customary in New York and in all other cities where they try to do good work to let only the secondary wires come inside of a house. Mr. Pope's brother was killed by touching a high-tension line wire which had been installed inside of his house. That insulation was poorly done. You can make an electric circuit just as dangerous or as safe as you like. There are all sorts of safeguards. There used to be a good many cases of people being hurt. You don't hear much of them nowadays, because proper precautions are taken.

Dr. Waite : I presume you have frequently seen where certain men claimed to have taken a large number of volts in the body by taking hold of the wires. I was reading, perhaps a year and a half ago, where a man claimed to have taken fifteen hundred volts by picking up a wire which had fallen out of a brush. Now, the resistance of his body was so great that he did not begin to take any such voltage.

Mr. Wolcott : The way in which you grasp a wire makes an enormous difference through means of the resistance of the skin, especially if your hands are dry, depending on whether you just touch the wire with one finger, with two fingers, or take hold with the whole hand ; in other words, most of the resistance is right in the skin.

Dr. Waite : I have heard a great deal about these billions of vibrations and oscillations ; I would like to know how they find out, if they have any way of measuring them.

Mr. Osterberg : You can easily read it up. It is a very tedious matter to demonstrate. Herz describes it completely. You can determine the self-induction, and by knowing the relation between the two the time and number of oscillations can be calculated.

ORIGINAL TRANSLATIONS.

ELECTRO-AMYGDALOTOMY AS A MEANS OF ABLATING THE TONSILS WITHOUT HEMORRHAGE.

BY DR. MOUNIER.

Far be it from us to claim the discovery of a new operation. The operation of removing the tonsils by means of the galvanic wire has been done for several years, and yet it has not the place it deserves among surgeons or even among throat specialists. The author frequently makes use of this method of removing the tonsils and has yet to learn its disadvantages. He prefers it specially for two reasons : First, because the absence of danger from hemorrhage leads physicians to rid their patients at a single sitting of an infirmity which renders so many people really miserable. Also to combat the present tendency toward the operation of ignipuncture for hypertrophy of the tonsils, when it generally gives bad results.

The author has used platinum wire, flexible iron wire, and stiff steel wire. He prefers the latter for the reason that it holds its shape when applied, which the others do not. The part to be removed can be seized better and taken away more quickly on account of the stiffness of the loop. Finally the steel wire is a good deal cheaper than that made of platinum. The steel wire should have a section of at least two-fifths of a millimeter. If it is less it is liable to break during the operation, either because the current is too strong and melts the wire, or because it is too weak and the pressure required to pull the wire through the tissue is strong enough to break it. The instrument should be supplied with a new steel wire at each operation.

When the operation is performed at the office, storage cells are the best to use, as the current is constant and easy to handle. On the other hand, they are very unreliable when carried about. When operating outside the battery of Dr. du Rocher, with two elements, acts very well. The operation of removing the largest and hardest tonsil does not take more than five seconds.

Its advantages are as follows: 1. Complete absence of hemorrhage, even when the glands are large. 2. Rapid and almost painless operation. 3. Ablation as complete as possible, even when the gland projects very slightly and could not be operated upon by means of a cutting instrument.

THE ELECTRICAL TREATMENT OF CONSTIPATION.*

BY DR. COMTADE.

The author gives the following indications for the treatment of chronic constipation.

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* *Journal des Practiciens*, 1896.

The treatment should be begun with the static charge of a quarter of an hour's duration with the generalized breeze, and static sparks upon the abdominal region. The treatment, properly speaking, consists of the local galvano-faradic electrization of the intestine itself.

Apparatus:

A large plate of tin, covered with chamois skin.

A cylindrical carbon electrode, 4 centimeters long and 8 millimeters in diameter, fixed at the extremity of a partially rigid insulated conductor.

A circular carbon electrode, 4 centimeters in diameter, also covered with chamois skin.

A battery of twenty or thirty cells with collector, interrupter, pole-changer, and galvanometer.

A faradic apparatus with two coils, one of coarse wire and the other of fine.

The carbon electrode is first introduced into the rectum as high as possible. The large plate electrode is placed upon the abdomen, over the sigmoid flexure. If there is any reason for supposing that the trouble has its seat in the cæcum, then the plate should be placed over this organ. Through these points the faradic current from the coarse wire should be passed for three or four minutes. The wires are next attached to the galvanic apparatus, and the current passed in the following manner: It is run rapidly from zero up to 40 ma. and then back again, so as to form so to speak raid waves. Each wave should only occupy a second. The current is also rapidly interrupted by making and breaking it. The current should not be allowed to flow continuously for any length of time, for fear of burning the skin. The intensity of the current should depend somewhat upon the sensibility of the patient, but in any case it should not go beyond 40 ma. The galvanic current should be frequently alternated and the position of the electrodes should also be changed from time to time. The treatment is finished by placing the large plate in the lumbar region while the small carbon electrode is moved about over the abdomen. The galvanic current is first applied, being used in the manner already described. The cords are then attached to the secondary coil of fine wire and a sort of a electric rubbing given to the abdomen. The treatment should be given three times a week.

EDITORIAL.

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THE TRIALS OF AN EDITOR.

Of course an editor knows everything, for of what use is he if he does not? He is the general storehouse of all information, not only dispensing and disseminating, but he is at all times on tap to the public to which he caters and which he pretends to instruct. There is generally a lurking suspicion in the mind of a man who writes to ask the editor a question, that an answer may be found in his books, but it would take an hour or more to look it up and a letter can be written in five minutes. And then, too, it is pleasing to the editor's vanity, now and then, to be asked to give instruction to one of his weaker brethren, and no subscriber, if he has any gratitude in his composition for the very pleasant and instructive hours he has had from perusal of the editorial columns, would withhold such pleasure. But somebody has said there is never a rose without a thorn, and so it is with the editor. He gets a letter from one of his admiring readers who wants to know about a certain matter, and, knowing the editor, according to his statements, to be one of the greatest authorities in the world upon that subject, proceeds to ask more questions on one sheet of paper than can be answered on forty. The editor at once goes to his bookcase, takes down a book, looks up the answer, and writes a long, authoritative reply conveying the impression of his wonderful knowledge of the subject, without so much as a hint that it was not drawn from the cells of his cranium instead of the shelves of his bookcase; but the next letter he opens causes him to knit his brow and stroke his chin thoughtfully. He wanders rather aimlessly to his bookcase, before which he stands undecided for a while; then he takes down one volume after another, and finally abandons the search in despair. It is an awful thing for an editor to have to own he is flunked, and only those who have sometime in their lives had such an experience can appreciate his feelings of humiliation, but, nevertheless, it is always better to be outspoken, and so we admit we are unable to answer the following question, which we received some time ago. It will give a little solace to our feelings if we are allowed to say that we have cultivated the society of learned men in order that we might put the question to them and profit by their knowledge, but in every instance we have been disappointed, and the manner in which they have looked at us, and the smiles which have curled around their lips have not been particularly flattering to us; so, in order to avoid such personal reflections, we have concluded to ask the question through the medium of the editorial column, where the looks and smiles referred to will not be within our range of vision.

The following is the much pondered question:

"Mr. Editor, Dear Sir: I write you regarding therapeutics. I had one placed on me a year ago when in a state of intoxication and have been unable to get it off. I would like very much to have it removed as it interferes with my work. If you will send me the desired information, I will gladly send you a dollar for your trouble."

Our first thought, being of the ethical school, was to recommend some remedial agent of recognized professional merit. As our mind wandered along down the line of treatment we suddenly seized upon the homeopathic law, "similia similibus," as it is claimed to cover everything, and contemplated advising him to get intoxicated again; but upon further reflection we came to the conclusion the sufferer must have been undergoing this process of treatment when he wrote the above letter. Being thus baffled as to all legitimate resources we put conscience in our pocket and began a search among the so-called quack remedies, taking in everything from Brandreth's Pills to Lydia Pinkham's Compound, but, copious as is the literature, and while each claims to cure everything, in looking over the list of disorders for which they are recommended, while we found everything else that man could be heir to, nothing was said about the one condition of which we were in search.

We are aware that some who do not appreciate our high aims and sensitive feelings will not hesitate to insinuate that our great anxiety is of a mercenary character, that it is the dollar which awakens our deep interest in the matter. We do not wish to deny that we are influenced by money considerations to the extent of the average man, but to prevent the idea becoming general that it is our sole aim in this matter, we wish to say that the letter was from Colorado, and we are liable to be paid with one of those dangerous affairs which have become such a great menace to our country,—that is, if we take the words of our learned statesmen,—a silver dollar. While we are willing to admit that the feeling of this detestable object in the palms of our hands still has a pleasant sensation, the mention of it always brings up the mathematical proportion of 16 to 1, which, since the last election, has been so indissolubly associated with it, producing such chilly sensations up and down our spine, that we feel no one can accuse us in this matter of purely mercenary motives. Now, as this ponderous question is given to the public, we feel a sort of relief from the shifting of responsibility, but will anxiously await the solution of it by our readers.

BOOK REVIEWS.

DISEASES OF THE RESPIRATORY PASSAGES. By CHARLES PORTER HART, M. D., Author of "Nervous Diseases," "Diseases of the Spinal Marrow," "Intracranial Diseases," "Nervous Therapeutics," etc.; Honorary Member of the College of Physicians and Surgeons of Michigan, etc. Second edition, rewritten and enlarged. Cloth, 350 pp. A. L. Chatterton & Co., New York.

Each year is bringing so much that is new to the practicing physician, both in remedies and in surgical instruments, that an author finds it necessary to rewrite his books to bring them up to date. This work, however, the preface tells us, has been some time out of print, and we are glad the author has given us a new edition of what was first published in serial form.

The book is divided into sixteen sections, the first giving the anatomy of the respiratory passages, and the second, the exploration of the air passages.

In exploration great advances have been made in the last few years in the diagnosis and treatment of diseases of the larynx and posterior nares. By the use of the laryngoscope or the rhinoscope the physician is enabled to illuminate the mouth and throat of the patient so that he can intelligently treat the case. In this section the author gives full descriptions and illustrations of all the latest appliances used for exploration.

The sections following take up the different diseases of the nose, throat, etc., giving the symptoms, ætiology, prognosis, treatment, and therapeutic indications with clinical notes under each section.

The book is illustrated with 117 cuts of instruments and apparatus for local treatment which the writer has found to be the best suited to the purpose. The work will be a valuable addition to any physician's library. A. J. F.

EPITOMES.

ELECTRIC TREATMENT OF GASTRO-INTESTINAL AFFECTIONS.

Max Weiss in *Centralblatt f. d. gesammte Therapie*, reviews the writings of experimenters and summarizes the results, and gives his own experience. Galvano-faradization is recommended in paretic conditions of the esophagus and cardia. One pole of a galvanic battery is connected with the opposite pole of the secondary coil of a Du Bois-Raymond, the other (usually the anode), with a broad electrode, is placed over the sternum. The free pole of the secondary coil is connected with an electrode introduced either into the esophagus or stomach by means of a sound, or applied to the inner margin of the sterno-mastoid on either side. The séance should be of five minutes' duration, if this electrode is used internally, or ten if externally.

Gastralgias and gastric neuroses call for galvanizing. The electric sound is required only in obstinate cases, as the affection usually yields to external galvanization with a current of 5 ma. and gradually increased to 25 ma. Vomiting of hysteria and of pregnancy, and that of gastric crises, requires external galvanization with a large electrode over the dorsal vertebræ and a smaller one over the tender spot in the epigastric region, and a fairly strong current (up to 20 ma.) allowed to pass.

Obstinate gastralgia, even if due to the cicatrization of a gastric ulcer, may yield to internal galvanization by means of a current of from 10 to 15 ma.

Motor insufficiency of the stomach, with dilatation, should be treated with internal faradization, with which may be advantageously combined massage. Some strongly recommend the external galvano-faradic massage, stroking the epigastric region vigorously with an electrode attached to the free pole of the secondary coil.

In correcting secretory defects in the stomach, internal electrical treatment is of value, subacidity requiring faradization, and super-acidity galvanization.

Much benefit is derived from systematic stabile and transverse galvanization of the abdomen with powerful currents, placing the cathode over the dorsal spine and the anode on the epigastrium.

Habitual constipation is best treated with galvano-faradic massage, galvano-faradization, and, in susceptible patients, the galvano-faradic band. For galvano-faradization, the electrode connected with the free poles of the galvanic battery should be inserted into the rectum, and the electrode leading from the secondary coil is stroked over the skin around the navel and along the large intestines : massage should not be employed with this measure.

In atony of the gut galvano-faradization is of much value, and by some recommended in the reduction of volvulus and incarcerated hernia.

THE USE AND ABUSE OF THE GALVANO-CAUTERY.

The *Clinical Chronicle* says editorially that the galvano-cautery, in rhinological practice, is the most useful agent, if it is employed in properly selected cases and in skilled hands. A Hirschmann (Berlin) handle is preferred. A trigger is more easily managed than the push button, and it is more convenient and less apt to short-circuit. The copper should be thoroughly insulated and so made that it can be readily asepticized. A good length of knife is from 3 to 3½ inches from the handle to the platinum tip. Cleanse the nasal cavity thoroughly with a coarse spray of an alkaline solution to which a little borolyptol has been added. Have patient blow his nose to remove all loose secretion. Moisten a pledget of cotton with an eight per cent. solution of the muriate of cocaine to which two grains of resorcin (to the ounce) have been added, and introduce carefully against the tissue to be cauterized, avoiding the nasopharynx and the upper lip. Incline the head forward for the first, and a napkin can be held by the patient below the nostrils for the latter. Leave the cocaine-soaked cotton in the nostril about four minutes, and another pledget can be introduced, if necessary, for the same length of time. Don't spray the nasal cavity with a cocaine solution for the galvano-cautery operation. After removing the cotton, thoroughly dry with absorbent cotton the surface to be operated upon. This is most important and is too frequently neglected. The cautery point is introduced *cold* into the nostril under good illumination of the parts ; turn the electricity on by pressing the trigger and sear the tissue. A cherry-red heat should be used for superficial burns, and a whitish heat for deeper, submucous burns. A white heat must be used upon the tonsils. No hemorrhage should follow, if the cautery has been carefully introduced and withdrawn. The cautery point is withdrawn, still heated, from the surrounding parts, after the cauterization ; but when it is again free in the lumen of the nostril, the current is instantly shut off and the knife withdrawn cold, so as not to injure contiguous parts. The knife should be applied at a right angle deep into the tissue, and repeated often enough to have the desired effect. The cautery should be drawn from the posterior entirely to the anterior extremity, and one linear incision made above the other in operating on the turbinates. Treat each case individually.

The cauterized area is now touched with a cotton-wrapped probe that has been dipped in an aqueous solution of pyoktannin, and then blow in a thin layer of aristol. Do not spray the nose with anything. Repeat the application of pyoktannin and aristol in twenty-four hours. The scab or slough is ready to come off about the third or fourth day. Gently pick off with a pair of forceps and spray the nose as usual.

TREATMENT OF NOCTURNAL ENURESIS BY FARADIZATION.

Dr. G. Koster of Halle gives his treatment of nocturnal incontinence of urine in the *British Medical Journal.* The patient first micturates, then is placed on his back and an ordinary electrode, connected with the positive pole of the faradic apparatus, is applied to the pubic region. The copper wire connected with the negative pole is not provided with an electrode, but at the free extremity the isolating layer protecting it is scraped off, so as to uncover about half a centimeter of the wire, which is then carefully disinfected by dipping it in a five per cent. carbolic acid solution and introduced to the depth of 1 or 1½ centimeter into the urethra of the patient. The current is then turned on, at first very feebly, but gradually increasing the strength as far as the patient can bear it, when the action is continued for two or three minutes, after which the strength of the current is somewhat reduced and then again progressively increased. This diminution and progressive increase is repeated once more before the sitting is ended. The total duration of each faradic application is from five to seven minutes.

By this treatment a complete recovery, both in boys and girls, is sometimes attained, but on an average two treatments are required. No treatment is required as long as involuntary emissions of urine are absent, but the moment another attack occurs an application should be made without delay.

ELECTRICAL TREATMENT OF UTERINE, MAMMARY, AND OTHER DISEASES.

BY HERBERT W. WHITE.

Dr. White, in the *British Medical Journal*, gives his ten years' experience in the above treatment in a series of cases.

CASE I.—Mrs. A., æt. forty-four, had a large solid tumor which completely filled the pelvic cavity and reached above the umbilicus; a history of hemorrhage, pain, and bladder symptoms; os could not be felt, as it was impossible to advance the finger more than half an inch in rectum or vagina. The active pole (anode) was placed in the vagina; strength of current 100 ma. for ten minutes. Entire relief from pain, hemorrhage, and vesical irritation. Had nine applications in three months. Five more applications and patient was quite well.

CASE II.—Mrs. B. Periods had recurred every twenty-one days for ten years, were profuse and lasted seven days; fibroid filled right side of pelvis, sound passing 6½ inches. Fifteen applications were made in five months—from 80 to 100 ma. being passed. "Tumor smaller, firmer, and more movable." Patient quite well.

CASE III.—Mrs. C. Intra-uterine nodulated fibroid. Ill for two years and was blanched from repeated hemorrhages. Eighteen applications of from 70 to 100 ma., with entire relief to the symptoms.

CASE IV.—Mrs. D. had a fibroid to the front and right of uterus; a minor operation was performed to arrest growth and relieve symptoms. No improvement. Commenced applications of electricity, 80 to 100 ma. in January, 1895; and in February the tumor was smaller and rapidly becoming pediculated. Symptomatically cured.

CASE V.—Mrs. E. had hemorrhage and pain from a uterine fibroid. Entire relief of symptoms was given by eight applications of electricity; 100 ma.; ten minutes' duration.

CASE VI.—Mrs. A., æt. fifty-five, had fungating hematodes of left cheek; occurred first as a small ulcer twelve years before. Tumor 2 inches long, 1¾ inch broad, and stood out from the cheek ¾ of an inch. Seventeen applications (negative needle, 20 ma.) Two months after the beginning of the treatment dressings were discontinued, as tumor had healed.

CASE VII.—Mrs. B., æt. fifty-two, had epithelioma on right side of nose for three years: excised; returned twelve months later. Twenty-three applications were made in two months—negative needle was inserted in margin of the diseased tissue; 10 ma. Disease entirely cured.

CASE VIII.—Mrs. C., æt. fifty-six, had carcinoma of the breast; great pain. Eleven applications were made in three months; tumor decreased in size, pain less, and after five more applications entirely disappeared, and a favorable prognosis was given. Tumor disappeared and has a fair use of arm.

CASE IX.—Mrs. D. had uterine cancer; cervix a gaping, ragged hollow; bleeding at slightest touch. Eight treatments (cathodal needle, 80 ma.) Hemorrhage controlled, but pain was nearly as severe as before. She gained in strength and was more comfortable. Died twelve months later from extension of disease to other organs.

CASE X.—Mrs. E., lupus of the face. Four treatments were given (negative needle; 40 ma.) and case absolutely cured.

CASE XI.—Epithelioma of the lip now being treated, and looks as if a perfect cure will be attained.

CASE XII.—Horny growth in palm of hand; stone mason; entirely prevented him from closing his hand on his chisel. Three applications caused entire disappearance (cathodal needle, 20 ma.)

CASE XIII.—Horny growth of foot also disappeared after three applications.

Warty growths of face, hand, and foot are most satisfactorily treated in this way.

Pelvic peritonitis, with adhesions, after all acute inflammation has subsided, almost invariably clears up after two or three treatments with electricity.

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ORIGINAL ARTICLES.

ELECTRICAL EXPERIENCES IN GYNECOLOGY.

BY CHAS. PORTER HART, M. D., WYOMING, O.

Certain electrical principles and phenomena are now sufficiently well established to form a secure scientific basis for clinical procedure in the great majority of gynecological cases amenable to electrical treatment.

I trust I shall be pardoned for taking a rapid glance at a few of the more prominent of these, since they will form a suitable introduction to the clinical history of some gynecological experiences that I propose to give hereafter.

1. *In the galvanic current, the action of the positive pole, or anode, is sedative or anodyne, contractive, drying, and hardening to the tissues, by reason of which it is also hemostatic.*

The sedative or anodyne action is chiefly due to the liberation of acids at the anode, while the drying and hardening effects are referable mainly to the liberation of oxygen and the non-metallic chemical elements at the same pole.

These effects are for the most part electro-chemical, that is, partly electrical and partly chemical, even when the intensity of the current is comparatively weak.

That the drying and hardening effect of the anode on the tissues is not *wholly* due to chemical action, as maintained by Manteucci and others, but is partly electrical, or electro-mechanical, is evident from the fact that the serum of the tissues, being transported in the direction of the current, or toward the cathode, necessarily has just such an effect: in fact, it is highly probable, I think, that this is the chief factor in the drying and hardening process, though doubtless the contraction of the tissues at the anode also tends to produce it. This view is further supported by the observations of Ominus and others, that when the current is strong, the electrotonic state diminishes and afterward disappears, while on the other hand this state is induced when the anode is separated from the nerve by non-conducting tissues.

While Apostoli claims that the positive or acidifying pole is pre-eminently hemostatic, M. Tripier calls in question the current doctrine on this subject,* claiming that both poles are hemostatic or the reverse according to circumstances—intensity of the current, condition of the tissues, electrolytic and chemicaustic effects, etc., electrolysis giving chemical effects and provoking physiological reactions.

2. *The negative pole, or cathode, is stimulating, congestive, liquifying, and absorptive.*

These effects are in part explained by the fact that the alkalies and fluids are precipitated at the negative pole, since both alkalies and fluids have a softening effect on the tissues. Stimulation at the negative pole must also have the effect of increasing the secretions at the cathode, the stimulation being partly due to electrical and partly to chemical action, for it is a well-known fact that alkalies increase the sensitiveness of the nerves.

That absorption takes place more readily at the negative pole than it does at the positive, has been established by an abundance of clinical evidence, especially in the case of cicatricial tissue, which is rapidly absorbed by direct applications of the negative electrode.

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* *Bul. de la Soc. d'Électrothérapie*, 1896, No. 5.

3. *Galvanic electricity promotes in the highest degree the nutrition of the tissues.*

Under this head we have (1) vasomotor effects, producing dilatation of the blood vessels and lymphatics, facilitating the circulation of both the blood and nutritive fluids, and thereby increasing absorption; (2) vascular, osmotic, and molecular changes in the tissues, thereby promoting nutrition by increasing their power of imbibition, the proliferation of their cellular elements, and their genetic development; (3) functional and organic (interstitial or molecular) effects on the nervous system produced by electrical stimulation and depression; (4) interpolar action, affecting the mechanical transport of the tissue-fluids from one pole to the other.

4. *Electrolytic and electrocaustic effects are confined almost exclusively to galvanism, and depend chiefly on the intensity and duration of the current.*

Electrolysis results from the decomposition by chemical action of the battery-solution forming the chain, or medium of communication between the poles, termed the electrolyte, whereby acids and oxygen or other electro-negative (*non-metallic*) elements, are formed around the positive pole, and the alkalies and bases, hydrogen and the electro-positive (*metallic*) elements around the negative pole, the decomposition taking place only at the points of contact with the poles.

A secondary chemical action, termed metallic electrolysis, takes place between the liberated elements and the positive electrode whenever the latter is composed of a metal, such as copper or iron, capable of being acted upon by them. In this way the electrode becomes corroded and oxidized by the acids and oxygen around it and may entirely destroy it. For this reason Apostoli makes use of platinum or other non-oxidizable metal for the positive electrode, which is thus enabled to exert its full electrolytic and electrocaustic power on the tissues. Gautier, on the other hand, avails himself of this form of electrolysis, in which the serum of the tissues constitutes the electrolyte, employing it by preference for the interstitial treatment of a great variety of diseases, such as uterine, urethral, and nasal inflammations and hemorrhages, hemorrhoids, hemorrhagic fibromas, anal fissures, nasal polypi, papilloma, cysts, chronic gonorrhea, tuberculous abscesses, and even such diseases as lupus, sycosis, and cancer. In cases attended with hemorrhage, Gautier uses a copper electrode at the positive pole, the resulting chemical action producing oxychloride of copper—a substance which he proved to be a powerful hemostatic. The cauterizing effect in Gautier's method, unlike that of Apostoli's, is almost nil, while the interstitial electrolytic action is most energetic.

Before dismissing this point, I wish to call the attention of the society, by way of explanation, to the clinical cases cited by me in a previous communication (See *Trans. Nat. Soc. of E. T.*, 1895, p. 11), in which acute and subacute cases of neuritis were referred to as more successfully treated with the cathode at the seat of inflammation than with the anode, contrary to the usual doctrine. In this article the fact was inadvertently omitted that the cathode employed was composed of *aluminum*. Perhaps my exceptional experiences in these cases is due chiefly, if not altogether, to the fact that a reversed cataphoric action is produced by this metal, or rather, that the aluminate thus formed, according to the theory of Gautier, has the effect of changing the direction of the current from the cathode to the anode, thus producing at the cathode the sedative action usually ascribed to the anode.

5. *The galvanic current is constant and continuous, while the faradic or induced current is alternating, inconstant, and intermitting.*

Although the induced current produces effects, in some respects *sui generis*, it is nevertheless identical in its nature with that of the galvanic current, there being no inherent difference between them. And yet, the physical effects of the two forms are, in many cases, extremely diverse, for while the galvanic current produces the greatest molecular and the least functional action, the faradic current, on the contrary, produces the least molecular and the greatest functional effect.

The functional influence of the faradic current, acting through the nerves, displays itself chiefly in the muscular system, producing more or less powerful contractions, according to the quantity and quality of the primary current (which latter is the same as that of the source from from which it is derived *) and the intensity of the induced current (which depends upon the length and fineness of the wire in the secondary coil), and the rapidity of the vibrations, or interruptions of the current, the muscular contractions taking place only at the interruptions, when letting on or shutting off the current.

This property of the faradic current to produce muscular contraction with comparatively weak currents renders it a powerful mechanical hemostatic in cases amenable to muscular compression, and is most efficient when, as in ***post-partum*** hemorrhages, both the tissues directly involved and those of the surrounding structures are brought under its influence.

In paralytic cases very little if any good will result from faradic electricity, unless some marked muscular contraction is induced by the application. This, however, is not difficult to secure, provided the case is a purely functional one; that is to say, if it is not complicated in any way with nervous or muscular degeneration. In the latter case the constant galvanic current is far more effective than the induced faradic current.

With these simple elementary observations, I proceed to cite a few illustrative cases:

CASE I.—In January, 1873, I was called to attend Mrs.

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* *I. e.*, galvanic ; hence the similar effect of strong galvanic currents.

D., a delicate blond woman, aged forty-three years, in her third confinement. She told me that in her previous ones she had come near dying from hemorrhage, and she hoped I would adopt such measures as would effectually guard against its recurrence, as her old family doctor, now deceased, had informed her that she would always be liable to such hemorrhages, as she was constitutionally inclined that way. Ergot at once suggested itself as a preventive remedy, as, according to the old authorities, uterine hemorrhage never occurred when the patient was fully under the influence of that remedy; but as I had already had a contrary experience (see *Hom. Journ. of Obstet.*, May, 1880), I gave the medicine no further thought. Fortunately, I noticed a magneto-electric machine on the table, open and ready for use, the patient having it for the relief of a neuralgic affection with which she was troubled. The child was no sooner born than the patient became blind and exsanguine from loss of blood, while an ominous gurgling emphasized the nature as well as the danger of the condition. Hastily seizing the instrument, I at once placed the negative electrode (a brass rod passing through a glass insulator and terminated by a metallic knob) at the mouth of the womb, and with the other a sponge-holder above the os pubis, wrapped in a wet napkin, I sent shock after shock, in quick succession, through the womb. Vigorous contractions immediately took place and the hemorrhage soon ceased. No bad effects followed the operation, although half-decomposed clots were expelled several days afterward. The patient made a good, and, under the circumstances, a comparatively speedy recovery.

CASE II.—Miss W., a brunette of eighteen years, consulted me in April, 1875, for a dry, hacking cough, which had troubled her for several months. Her sister was already dying of consumption in another room. I made a careful physical examination of her lungs, but could detect no tubercular deposit, either by auscultation or percussion.

Two or three large spots, of a brownish-yellow color (cloasma), were noticeable on the anterior portion of the chest, and upon inquiry I learned that she had not menstruated during the last eight months. She stated that she had taken "any amount" of emmenagogue medicine, and that none of it had done her any good. Desiring to relieve the amenorrhea as soon as possible (as I regarded that as the immediate cause of the cough), I applied through the vagina a low tension faradic current to the uterus daily for nearly two weeks, occasionally varying the intensity so as to produce marked muscular contraction, at the same time using hot mustard pediluvia. This treatment effectually overcame the trouble, the amenorrhea, cough, and maculæ disappeared almost simultaneously, and she afterward married, raised a large family of children, and is still in good health.

CASE III.—I was called, May 13, 1869, to a neighboring town, to see Mrs. T., a large German woman, aged about forty-five, who had never borne any children, but had always been "regular" up to within the last five months. Since that time she had constantly suffered from headache, shortness of breath, and a general sense of oppression, which she attributed to a "change of life." I found the patient suffering not only from the symptoms just mentioned, but also from an immensely swollen parotid gland, "as hard as a stone," causing great pain and anguish as well as some fever. Convinced that nothing short of a restoration of the menstrual flow would effectually relieve the acute symptoms, I advised hot fomentations to the supra-pubic region, hot-water vaginal injections, and cotton bark tea *ad lib.* These measures proving ineffectual, after twenty-four hours had elapsed I resorted to faradic electricity, using a short, coarse wire secondary coil, the electrodes being applied as before described. The full power of the battery was turned on, producing strong muscular contractions in the abdominal and uterine walls, each operation lasting about fifteen minutes. These applications were repeated, on the average, about once every hour, but on account of abdominal tenderness supervening, I substituted a high-tension secondary coil for the coarse one. At 4 P. M., after seven or eight applications had been made, a "show" occurred, the amount increasing gradually, until after another twenty-four hours' treatment, at longer intervals, a copious flow took place, and the patient's symptoms were quickly relieved.

CASE IV.—Sarah T., a girl of seventeen employed in a paper mill, suffered peripheral paralysis in the left lower extremity from a bale of wet rags falling upon it. For nearly four months the paralysis remained in *statu quo*, notwithstanding the fact that massage and internal remedies without number were assiduously employed. The limb remained cold and of a pale violet color, with some œdema of the foot and ankle. Galvanism was first tried, a feeble descending current being applied daily to both the spine and limb. This was continued for nearly a month with so little improvement that the patient became discouraged, and was about to discontinue treatment, when I concluded to substitute the induced for the constant current. The patient was so sensitive to this current that I was compelled to use a very long fine wire in the secondary coil. Amendment of the paralysis soon took place after the change was made, but curiously enough, coincidently with this amendment the case became complicated with neuralgia of the womb, which seemed to increase in severity as the paralysis diminished. However, I continued the faradic treatment, at longer and longer intervals, until the patient was able to walk without trouble or fatigue. As the neuralgia continued unabated, I resumed the use of the constant current, which soon subdued it.

CASE V.—Mrs. E., the wife of an allopathic physician, aged forty-two years, mother of a grown son, applied to me for the relief of an "intolerable headache" in the top and back part of her head, which had existed more than a year, and which she declared would, if not relieved, "soon set her crazy." She had been under treatment at the Soldiers' Home at D. for several months, by a doctor at that institution who was a near relative of hers, for uterine catarrh, and since the treatment had been discontinued and the doctor had pronounced her "cured," she had been tormented with headache, which constantly grew worse and worse. On making a specular examination, I found a pinhole contraction of the os, which, upon attempting to pass a fine silver sound, I found to be entirely impervious. Upon inquiry I learned that caustic applications had been made "almost daily" for several weeks, and to this unscientific and unjustifiable treatment I attributed the stenosis. I was confirmed in this opinion by the fact that there was no appearance of there having been at any time any laceration of the uterine neck, nor the slightest trace of cicatricial tissue externally, the cervix being perfectly smooth, regular, and non-striated. At first I was inclined to think that the condition was due to a hysterical or spasmodic closure of the os, but repeated examinations with the finest silver probes proved conclusively that the case was one of stenosis pure and simple. As this was a good opportunity for testing the virtue of the negative pole in promoting absorption, I applied a fine platinum electrode to the center of the os, or rather, to the minute depression representing it, the positive pole being applied externally by means of a large padded abdominal electrode. Two applications a week, of from ten to fifteen minutes each, were made with great regularity, employing a current of from 10 to 15 milliamperes of negative electricity, for a period of about three weeks, before the os was rendered permeable, after which I was enabled to pass a small-sized silver sound. The "dreadful headache" was at once considerably relieved, and a short time thereafter disappeared altogether. A few more applications completed the cure, which was all the more satisfactory from the fact that shortly after the treatment was discontinued the patient again became pregnant, and in due time had another boy!

As this paper is already sufficiently extended, I will defer the recital of other cases to another time.

In closing this first installment of my clinical experience in electrical gynecology, I am aware that the principles referred to, as well as the cases so far cited, are of the most common and elementary character, and my only excuse for bringing them before this body of electrical experts, is the fact that the great mass of the medical profession are still lamentably ignorant of even the first principles of the science.

ELECTRICITY IN DISEASES OF THE FEMALE PELVIC ORGANS.

BY F. H. CUTLER, B. S., M. D., CEDAR FALLS, IA.

Miss A., aged twenty-one, school-teacher, began menstruating at sixteen. The flow has always been scanty and attended with pains across the back and down the thighs, while the tenderness over the lower part of the abdomen is extreme. During the last two years her troubles have steadily increased, and her health has steadily decreased; till at the present time she is practically confined to her bed two weeks out of every three. Periods were regular for the first three or four years, but she is now menstruating every three weeks and the flow has become very profuse.

Two weeks of this time passes with her in bed, and one week is spent in the house with considerable pain and a distressed and indescribable sick feeling constantly present. Appetite gone, sleeps poorly, bowels constipated, bearing down pains, backache, and an irritable condition of the bladder constantly present.

Local examination reveals a mild vaginitis, eroded and enlarged cervix, uterus enlarged, and fundus tender, slightly retroverted.

Cavity measures 2⅞ inches, and upon withdrawing sound it is followed with quite free hemorrhage. Sound passes freely; no stenosis of external or internal os. There is much tenderness shown when sound passes internal os. Left ovary very tender to touch, but not enlarged. Right ovary normal. Patient comes seeking relief from pain.

I will describe in brief my treatment of the patient, as her symptoms and the remedy used represent a large number of patients treated during the year.

First.—The bowels were regulated by laxatives—Pill lapatic.

Second.—Nervousness was treated by sedatives: Elixir valeriate of ammonia with bromide sodium.

Third.—Electricity was the remedy relied upon to cure.

May 5.—First treatment was given, 10 ma. intra-uterine for ten minutes, with negative electrode on abdomen. Following this she received the current of tension, by use of bipolar vaginal electrode for twenty-five minutes. This was continued till all pain, of which she was complaining on entering my office, was relieved.

May 7.—Twelve ma. positive for thirteen minutes, followed by bipolar vaginal faradization.

May 9.—Twenty ma. positive for eight minutes, followed by bipolar vaginal faradization.

Patient says she is feeling much better, is stronger, bearing down pains nearly all gone, bladder trouble entirely relieved.

May 12.—Thirty ma. positive for five minutes, followed by bipolar vaginal faradization.

Reports appetite improving and bowels moving regularly.

May 14.—Positive galvanism 23 ma. for twelve minutes, followed by bipolar vaginal faradization fifteen minutes. Reports herself as feeling better in every respect. Backache gone, pains in thighs gone, sleeping well. Discontinued val-ammonia. Has taken no laxative in six days, bowels normal.

May 20.—Patient became unwell day following last treatment. Pains were not half as severe as they were last month, and the blood lost was less than half the usual amount. Feels greatly encouraged, as this "sick spell" is a great improvement on any which she can remember.

The following three treatments were positive currents of quantity, intra-uterine, negative on abdomen, given on alternate days, and for the purpose of reducing the size of the uterus, as it still remains slightly larger than normal.

July 8.—Patient reports herself as feeling perfectly well; has gained twelve pounds in weight.

With this patient, as I do with nearly all my patients before applying electricity, I introduce the vaginal speculum, remove all secretions, and thoroughly cleanse the vagina by using a cotton sponge in the dressing forceps, saturated with a 1–3000 solution of bichloride, and then again remove all remaining secretions by a clean sponge. This places the cervix in an absolutely sterile condition. The electrode, platinum, copper, or whatever metal is used, is made perfectly clean by immersing in bichloride, or carbolic acid solution, then carefully wiped with borated cotton before introducing. After the electrical application is made, I am in the habit of placing in the vagina a tampon, made by taking a small quantity of sheep's wool and placing it inside of a small piece of borated cotton, and tying it with a strong linen thread. The tampon is then saturated with a mixture of glycerine, and whatever remedies it is desired to use—borax, boracic acid, ex. pinus canadensis, etc., etc. These tampons I instruct the patient to withdraw on the following morning, and after their withdrawal, a vaginal injection, according to instructions, is to be taken. The above method, with slight variations, has given me almost uninterrupted success in this class of cases.

ORIGINAL TRANSLATIONS.

THE ELECTRIC RESISTANCE OF THE HUMAN BODY.

BY DRS. SPEHL AND SANO.

Of late years some authors have claimed that in certain nervous diseases the resistance of the human body to the passage of the galvanic current is greatly modified. If this were true clinical as well as legal medicine would have a new means of diagnosis of great value, the more so as it would be beyond the reach of simulation.

These statements seemed so important to us that we have made an earnest attempt to verify them, by discovering some method which would be simple enough to use in the clinic and at the same time sufficiently accurate to place the results obtained beyond dispute. We first rejected all the ordinary electrodes in general use, owing to the fact that in all of them the resistance must of necessity vary greatly. The two principal sources of error are: first, the different degrees to which the electrodes are soaked in the fluid used, and second, the amount of pressure exerted in holding them in place.

Still another source of error is the layer of air which is always present between the electrode and the skin. This will vary in thickness at different times and may materially change the result. In order to avoid these and other errors we have used as electrodes two jars, filled with a ten per cent. solution of chloride of sodium. The person experimented upon puts his hands into this solution up to the wrists. It is important that the solution should be ten per cent., as certain sources of error are thereby reduced to a minimum. Such sources of error are: slight evaporation of the liquid in the jars, or the fact that the hands of the person were wet with ordinary water before being placed in the jars. If the hands are submerged up to the wrists the results are fairly constant, even if they are pulled out or thrust in a little. The apparatus used in determining the resistance of the human body may be described as follows: From the battery the current passes through a commutator and thence to a differential galvanometer, where it divides into two parts, one going to a resistance box and the other to the jars in which the subject places his hands. The two currents then unite again and pass back through the commutator, and finally return to the battery to complete the circuit. The battery must be arranged so that the current can be increased or decreased. In order to do away as far as possible with the errors resulting from the polarization of the tissues, the current should be constantly reversed by means of the commutator already mentioned.

We will now show how the result is obtained with this apparatus. The subject plunges his hands into the jars up to the wrists. A resistance of say 1300 ohms is placed in the circuit and the current brought up to 5 ma. From time to time the current is reversed by means of the commutator. At first the needle of the galvanometer flies back and forth each time the current is reversed. By changing the amount of resistance a point is finally reached where the needle rests motionless at zero, or very nearly so. At this moment a current of equal intensity is passing along both branches of the circuit, and from the resistance on one side, which is given by the resistance box, we can tell exactly the resistance of the subject placed in the other branch of the circuit.

In order to arrive at this result with accuracy it is of course necessary to take into account the resistance of the various parts of the apparatus, which can be readily determined beforehand. It required but two minutes to perform this experiment, and the results obtained, in addition to being accurate, admit of easy comparison with others obtained in the same manner.

These experiments have been made during a period of two years, so that ample time has elapsed to allow of a judgment as to their value. In certain cases the resistance has remained the same during this whole period. These experiments have been made upon 39 well people and upon 62 patients. The whole number of experiments recorded is 264. The results are as follows:

Healthy Subjects.

Men (34) mean resistance	1337	ohms
Women (5) " "	1358	"
General mean for healthy subjects	1347	"

Patients.

Nervous diseases,	mean resistance . .	1517	ohms
Other diseases	" " . .	1665	"
All cases	" " . .	1503	"
Men (58)	" " . .	1505	"
Women (8)	" " . .	1404	"

Among the healthy men the lowest resistance was 700 ohms, the highest 1900 ohms. Among the healthy women 1120 and 1700 ohms.

The subjects of these examinations were of all ages, professions, and temperaments, but we have been unable to discover that these factors affected the resistance in any way. Judging by the means as given above, it would seem that sex had something to do with determining the amount of resistance, it being somewhat greater in women. If individual cases are taken, it is found that many women have a less resistance than men.

It is probable also that differences in the circulation do not affect the resistance. To prove this Weiss put an Esmarch bandage upon one arm and found that the resistance remained unaltered. In the case of patients it was found that the same person would show at different times well-marked differences in his resistance.

In considering the results obtained from the experiments made upon patients, we look upon them as being of great importance. It is here that the results obtained by us differ totally from those of other writers who have studied this question. In three cases of locomotor ataxia the mean resistance was found to be . . . . . 2668 ohms

Nervous diseases, mean resistance . 1639 "

Other diseases, " " . . 1665 "

It would seem that there was a slightly greater resistance to be found in patients, especially in those who did not suffer from nervous disease. The resistance of the women is greater than that found in the men, if we except the cases of locomotor ataxia. With these exceptions there is no possible way of classifying the cases which we have examined; nothing which shows a constant relationship between a given disease and the resistance of the patient. We do not think that the electrical resistance can be used as a means of diagnosing cases of nervous disease, although this has been claimed for it by some authors.

Eulenburg claims that the resistance is greatly reduced in cases of exophthalmic goiter, and that it even goes as low as 180 ohms. The three cases of this disease that we have examined gave a mean resistance of about 1400 ohms, which is slightly higher than the healthy average.

Vigouroux claims that the resistance is enormously increased in hysterical cases, going as high as five times the amount as seen in normal persons. The mean resistance of the cases we have examined is about 1400 ohms; that is, very little removed from the normal. Seglas and Vigouroux claim that in melancholia the resistance is enormously increased, reaching as high as 100,000 ohms. In three cases examined by us the figures were 1500, 1800, and 1700 ohms; that is to say, little if any removed from the normal.

From all that has gone before we feel justified in drawing the following conclusions: The most varied conditions of the system, both in health and disease, may have very similar resistances. While certain subjects present a constant resistance, others show a remarkable variation, even from day to day. The same disease may show very different resistances in different subjects, and may even vary in this respect in the same subject. As to the cause of these variations, our conclusion is, after carefully considering all possible factors, that it is due to the varying quantity of chloride of sodium in the tissues.

In order to prove this the following experiment was tried: One of us whose resistance is ordinarily about 1400 ohms, took with one of his meals a dram of chloride of sodium; the resistance taken immediately afterward was only 1120 ohms. To this may be due the greatly increased resistance which is found in locomotor ataxia. The gastric troubles which so frequently accompany this affection may act in some way to decrease the quantity of the chloride and thus raise the resistance.

ACTION OF THE ROENTGEN RAYS UPON THE LUNGS.

DRS. CHANTELOUBE, DECOMPS, AND ROULLIES.

The medical world is just now much occupied with the application of the X-rays in tuberculosis.

We think it therefore of interest to present a case.

Madam X., twenty-two years old, health delicate, married four years, has three living children.

Her condition was as follows:

Frequent dry cough, but no emaciation or fever. Lungs, heart, and kidneys appeared healthy.

The cough became more frequent and the patient began to lose flesh. Slight rise of temperature in the evening. Dullness at the right apex, exaggerated resonance, whistling respiration. Slight infiltration of the lung, with congestion.

The disease rapidly increased until acute tuberculosis of both lungs was clearly established.

The diagnosis was fully confirmed by microscopical analysis of the sputum. In view of the apparent uselessness of all known remedies in a rapidly progressing case of this kind, it was decided to use the X-rays alone. An induction coil giving a spark twenty centimeters long was placed in the patient's room.

The tube was placed at a distance of ten to fifteen centimeters from the patient's chest, which was covered by her chemise. The length of the exposure was half an hour, and the treatments were given daily from the 7th to the 15th and from the 18th to the 20th of February.

On February 7 the evening temperature was 39° Cent.; the 8th it was 38°; the 9th it was 38.4°; the 10th 38°. On this day there was profuse sweating. On the 11th diarrhea appeared for the first time; also epistaxis, headache, and cough more frequent than ever.

In the evening vomiting and pains in the hypogastric region on coughing.

On February 12 the morning temperature was 37.3°, the evening 39.5°. Diarrhea and urine loaded with albumin.

On the 13th the evening temperature was 38°; on the 14th 38.5°; on the 15th 38°.

On the 18th temperature 37° in the morning, 38° in the evening.

The menses appeared again after having been suppressed for two months. On the 20th temp. 39.6° in the evening.

An examination revealed the fact that the anterior portion of the lung which had been exposed directly to the rays had undergone an important modification. There was still slight dullness on percussion, but the blowing sound had disappeared, and on deep inspiration there were heard only a few fine mucous râles. It seemed, therefore, as if this part of the lung was permeable. This fact decided us to keep on with the treatment, although the general condition was no better, and the left lung was rapidly becoming involved.

We decided to apply the rays to the posterior part of the lung, giving two treatments a day.

February 21 the rays were applied in the morning to the base and in the evening to the summit of the right lung. Evening temperature 37°, night good without sweating or expectoration. Suppression of the diarrhea.

On March 1 patient complained of pain in the region of the right nipple, and examination showed quite a large patch of erythema. This soon became covered with vesicles, which united together by their edges and then broke, leaving a large ulcer.

It appeared twenty days after the commencement of the treatment.

From the 3d to the 13th of March an accident to the coil interrupted the treatment.

From the 14th to the 20th two treatments a day were given. The cough and the expectoration grew less.

On the 20th the skin on the back part of the chest became dry like parchment and covered with black points. The treatments were then stopped.

On March 22 the lungs were examined, and a remarkable change was noted. The cough is greatly diminished and the expectoration slight. The blowing sound has completely disappeared in both lungs, and the respiratory murmur is nearly normal everywhere.

The examination of the sputum was also very interesting. Out of four samples, three were negative. The fourth contained two isolated bacilli. None of the four contained either pus or elastic fibers.

The treatments were stopped on the 20th of March on account of the skin affection, and from that time on the patient's condition became worse and worse owing to the fact that she refused to eat. This difficulty was finally overcome, however, and she then began to improve.

On April 1 the diarrhea disappeared and the strength began to return.

After two months in bed the patient was able to get up and remain hours without fatigue, although the evening temperature was still 38.8°.

The condition of the lungs continued good, and the expectoration slight, while she coughed but seldom.

As her strength returned her cheerfulness came back with the hope of a speedy cure. The scars of the skin affection gave her a good deal of pain and they healed very slowly. We have given the details of this observation so that a just judgment could be formed of the condition of the patient and the action of the rays. The clinical symptoms as well as the bacteriological examination leave no room to doubt the diagnosis of acute tuberculosis, which in this case may be divided into four distinct phases:

First, the period of pulmonary infiltration and softening, with rise of temperature.

Second, the period of the application of the rays to the exclusion of all other treatment, and the aggravation of the general condition.

The eighth application of the rays was marked by a notable fall in the temperature, but the general course of the disease was not specially influenced, since on the 20th of February the temperature was 39.6° again.

The third period, during which two treatments were given daily, extending to the 20th of March, is marked by the diminution of the cough and expectoration, and almost complete disappearance of the bacilli of Koch.

The fourth period begins at the time when the treatment ceased, and allows us to judge of the results.

The patient takes nourishment well, the respiration becomes deep, and there is no dyspnœa, the diarrhea disappears, and the body strength returns.

The temperature still remains elevated, however, and the thermometer in the evening marks 38.5°, which leads us to think that the pulmonary lesion is not the only source of the trouble. Such are the facts which we have observed. It is as yet too early to announce a cure in this case, but at a later date when sufficient time has elapsed we will make known the final result. At present we simply wish to insist upon the fact that these lungs, which were undoubtedly affected with acute tuberculosis, have been almost cured by thirty applications of the X-rays. As no other form of treatment of any kind was given, we are certainly justified in claiming that the results obtained were due to the action of the rays alone.—*Archives d'Electricité Medicale*, May, 1897.

TREATMENT OF ATONY AND DILATATION OF THE STOMACH BY FRANKLINISM.

BY DR. REGNAIR.

The author has considered only that form of dilatation which is the result of indigestion, without considering that due to a mechanical obstruction. Without denying the importance of diet and medicines, he claims that the use of physical agents, such as electricity, massage, and douches, are extremely valuable in bringing back the tonicity of the stomach and restoring it to its normal size. He employs for the treatment the method known as vibratory franklinism, which he carries out as follows:

The patient is placed upon the insulated platform, which is united with the negative pole of the machine.

The positive pole consists of a carbon button covered with chamois skin, which is moistened and placed over the pylorus, that is, over the external border of the right rectus muscle. This electrode is provided with a spark gap worked by a thumb screw. When giving the treatment this gap should be about 2 or 2½ centimeters in width, which is sufficient to cause muscular contractions. This electrode is the same as that of Boudit of Paris, with the addition by the author of a micrometer screw so that the size of the spark gap can be controlled with more exactness.

After the electrode has been applied to the pylorus, it should then be placed over the cardiac orifice.

The treatment should be given every day for two weeks, and then gradually decreased in frequency.

Cases of this kind will as a rule require from one to three months' treatment.—*Archives d'Electricité Medicale.*

EXOPHTHALMIC GOITER TREATED BY ELECTRICITY.

BY DR. CROCQ.

Louise P., æt. forty-three years. Has never been ill before. The affection commenced two years and a half ago as a result of a great disappointment, and its beginnings were very insidious. She became very thin, felt indisposed, and suffered from violent palpitations. Soon she noticed that the left side of the neck was growing larger. The disease made rapid progress; the palpitations became more and more violent, and the legs became very weak. Soon there appeared muscular cramps, profuse sweats, neuralgias, cutaneous eruptions, loss of appetite, and vomiting.

About a year ago the patient was affected with intermittent general tremor. Heat was insupportable to her, and she was often compelled to pass the greater part of the night at an open window. She was out of her bed a great deal, as sleep was almost impossible to her. In the meantime her temperament changed entirely and she became impatient, irascible, and deeply melancholic.

Present condition, October 12, pulse 120, the beats violent and irregular. No signs of organic heart disease, only a well-marked anæmic souffle.

The tumor at the neck was the size of a large mandarin, smooth, and only slightly movable. The tumor was not in the median line, but on the left side of the neck. Deglutition was very difficult and painful. As to the eyes, there was only slight exophthalmos and increased flow of tears. The tremor was regular, short, and not intentional. The skin of the face was pigmented yellowish and not unlike the appearance in Addison's disease. The shoulders and the back were covered with an eruption of urticaria.

During the course of her disease this patient had undergone a large number of different forms of treatment, none of which had done any good, and her physician had urged upon her the importance of an immediate recourse to surgery. I did not believe in a surgical operation, as I consider the cause of this affection to be central, and located in the bulb. I resolved therefore to treat the patient with electricity, and I chose the galvanic current. The positive pole was placed at the back of the neck, the negative at the precordial region for five or six minutes (15 to 20 ma.), then over the tumor for the same length of time (25 ma.), then over the lumbar region for an equal time (15 to 20 ma.). At the same time the patient took the bromide of sodium, 3 grains a day, though this same medicine had been given before without result. Electricity was given every day, and from the third day improvement was marked. The general tremor and weakness of the legs completely disappeared, and the palpitations were greatly improved. The improvement was very rapid, and in a short time the cramps, the sweats, the neuralgic pains, the insomnia, as well as the melancholy, agitation, and muscular weakness, were entirely gone.

After fifteen treatments the exophthalmos had almost entirely disappeared, the tumor had greatly diminished in size, deglutition was again performed without difficulty, and even the pigmentation of the face was much less pronounced. The patient was now gay and full of courage. Her sleep was good and she felt well in every way. The treatment was intermitted for a week, but the improvement remained.

Discussion.—Dr. Crocq, Sr.—Removing the gland in exophthalmic goiter might be compared to removing the eye for ophthalmia, since in either case the operation could not reach the cause of the disease.

Dr. Hertoghe.—Heredity plays a certain part in this case, since there is evidently a thyroid diathesis. One of her sisters has amenorrhœa, and I consider that this symptom may depend upon lesion of the thyroid gland. When giving thyroid extract I have several times observed diminution of the menses, and even complete suppression.

In the family of this patient there are several cases of asthma, which I believe may depend also upon thyroid lesion.—*Revue Inter. Nat. d'Electrothérapie*, Nos. 7 and 8, 1897.

ATROPHIC PARALYSIS DUE TO COMPRESSION OF THE BRACHIAL PLEXUS.

BY DR. VIOGUROUX.

This is without question the commonest form of paralysis of the brachial plexus. The principal symptom is the atrophy. It is well known that if the compression passes a certain degree of intensity degenerative atrophy is sure to result. On the other hand, if the compression is slight, the paralysis is transitory and there is no change in the reaction.

There are therefore two forms of compression paralysis, one mild, and one severe. Is it possible to have atrophy in the mild form?

According to the observations of the author, atrophy may not only be present in the mild form, but it may easily attain to a degree which is entirely out of proportion to the gravity of the affection. It is neuropathic in its origin, but at the same time not degenerative. The reactions are normal in all respects; that is to say, it is simple atrophy.

The rapidity of development of simple atrophy is not less remarkable than the degree to which it sometimes attains.

This rapidity shows itself especially in the effect of treatment upon cases of simple atrophy where the affection has been stationary for months. Electricity causes a sudden improvement, which manifests itself in a few days by increase of the muscle both in strength and volume. The best form of electricity to use is that which produces the greatest number of muscular contractions.—*Progrès Médicale*, No. 25, 1896.

EDITORIAL.

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THE TIME TO PREPARE.

During the latter part of September the National Society of Electro-Therapeutists and the American Electro-Therapeutic Association hold their annual meetings, the former at Washington, D. C., the latter at Harrisburg, Pa.

The regular annual meetings of these two societies are of the greatest importance to Electro-Therapeutics. The benefit to the individal members by a comparison of methods and results must necessarily be great, but still greater is the benefit to the profession at large, which is beginning now to thirst after knowledge on the subject, by disseminating the high-class literature emanating from their annual meetings. While it is true that the articles in their original form are printed in but a few journals, mostly devoted to special work, it is also true that extracts from a large number of them are to be found in many of the general medical journals. These all tend to stimulate interest in the subject, which is all that is desired, for we believe that if a physician has interest enough to look into the subject carefully, he will realize its importance and assign to it its proper place in therapeutics. Responsibility is in direct proportion to influence ; if, then, the literature emanating from these societies has such a wide influence, all the more care should be taken in its preparation. It is not often that papers are read before these societies which do not show the result of clinical experience, and more or less thought on the subject. A very few of the papers, however, show a lack of preparation, being simply ground out at the last moment under great pressure ; they therefore lack those elements of reflection which are the most potent.

Now the summer is upon us, most physicians will be more or less at leisure for a space of one or more months. This play spell has been earned by hard work during the preceding ten months, and one does not feel like buckling down to writing articles, which is hard enough in the most stimulating weather of the winter months, but is still more tiresome in the sultry heat of summer. Yet, when is the time more propitious for meditation than when lying idly under the shade of a large tree with the birds chirping through its branches, or on the porch of a seaside cottage with the distant roar of surf becoming musical as we accustom our ears to it. This is just the time to prepare the paper, but not to write it ; that will come when returning to work in September invigorated by the vacation. All that is necessary to start this meditation in the right direction is to decide on a subject before leaving town, take a few minutes to look up the points in which we may be in doubt, and the paper is already one-third prepared. The meditation completes the second third, so in September but little remains to be done. If this course is followed not only will there be an abundance of material at the annual meeting of the electrical societies, but the quality will be all that can be desired.

BOOK REVIEWS.

THE INTERNATIONAL MEDICAL ANNUAL AND PRACTIONER'S INDEX. A work of reference for medical practitioners, with forty-one contributors. E. B. Treat, 241 West Twenty-third Street, New York. Price $2.75.

This book marks the fifteenth year of the appearance of the "Medical Annual." So well has it become known, not only by title, but its general plan, that about the most comprehensive review that can be made of it to the general practitioner is to say that it is a reproduction in detail of its predecessors. Each subject has been taken up separately, and all the advancement during the last year has been carefully written, sifting out the chaff, and condensing down the facts. The preface states that the aim has been to hold it within its original bounds, or nearly so, and that, owing to the rapid increase of literature and knowledge upon the various subjects of medicine and surgery, it has been found necessary to select those things which come within the range and necessity of the busy practitioner. We are sorry to note that the subject of electro-therapeutics as a separate division is left out; however, reference is made to electro-therapeutics in many instances, and some of the latest developments will be found in its pages. In spite of the efforts of the publisher to keep the size of the volume down, it is gradually growing until it is becoming rather ponderous. If the present rate of growth continues we may expect to find it appearing in two volumes. The neat mechanical work of the book is equal to its predecessors, and reflects credit on the old and reliable establishment of E. B. Treat.

RANDOM RIMES, MEDICAL AND MISCELLANEOUS. By Drs. N. W. and J. P. RAND. Boston: Otis Clapp & Son, 1897.

To our reviewing table the other day came a little volume of rhymes, "Random Rimes" the cover says, and we note the return to the old way of spelling the latter word which is sanctioned by the Standard Dictionary.

Physicians are brought in contact with two of the hardest facts of existence, disease and accidents. No matter whether their patients are in the homes of the rich or in the slums of the city, the same evidence of our mortality meets them daily and hourly. Is it any wonder, then, that in their few hours of relaxation they turn gladly from the prose of life to a lighter, brighter phase, *i. e.*, to fiction and poetry. There have been more than one of the profession who have written novels, some weaving into their stories their medical experience, but not often do they attempt the more difficult field of poetry. Rhymes do not always contain poetry, but many in this little book are musical and worthy of preservation. Some were written for dinners or reunions, while passing events or incidents of a busy life have suggested others.

As the beginning and end of all things to-day is the magic wheel, we are not surprised to find the book opening with "The Cycler's Song," and the most enthusiastic wheelman will find no reason to complain of the value placed upon his silent steed. Better than "pill or plaster . . . is a flying wheel."

The "Sekrit uv Sukces" is a new rendering of the Golden Rule that "What ye want uv a feller ter du fur you, you've gut fur ter du fur him," but the old truth and the foundation of the brotherhood of man remain the same though here expressed in the vernacular of the uncultured.

The book will be best appreciated by the medical profession, as laymen cannot so well understand the "shop" allusions. After a busy day it will while away a half hour before or after dinner, and give the tired brain just the change it needs.

MANUAL OF STATIC ELECTRICITY IN X-RAY AND THERAPEUTIC USES. By S. H. MONELL, M. D., Founder and Chief Instructor of the Brooklyn Post-Graduate School of Clinical Electro-Therapeutics and Roentgen Photography, Fellow of New York Academy of Medicine, etc., etc. William Beverley Harison, publisher, New York.

It has been aptly said that the electro-therapeutist should be a specialist in every department of medicine and surgery. Such is evidently the view of the author, for he has discussed everything susceptible of static treatment with the manner of one who thoroughly understands his subject, and knows whereof he speaks.

Naturally the book is long ; it is, however, longer than it need be, for the author has frequently repeated himself, probably for the sake of emphasis.

Occasionally there are evidences of haste in the preparation of the book, which interfere with its clearness. Thus the statement (p. 261) that "the energy of a current is dependent on its rate of change" is vague, and the context, "The dose increase therefore of 10 . . . or 100 ma. indicates the increase of intensity of action through an increase in the rate of motion," is but a part truth. The energy of a current is determined by the product of the voltage and the amperage.

One of the author's methods for determining the polarity of an influence machine is slightly misleading. He says (p. 50), "with the stream now in full and continuous action . . . the violet shows the negative pole, the white light the positive pole." With a short spark gap, the "stream" is white, when a little longer it becomes as the author states. With a still longer spark gap, the *violet* is seen at the *positive* and the *white* at the *negative*.

On page 150 the author still holds to the common conception of the quantity of current which can be determined by an influence machine, for he remarks, "the current from the static machine has long been known to be of immensely high voltage, and infinitely small amperage, without chemical effects." Compare the following from "Medical Electricity," by Kennelly and Houston (p. 348), in reference to the oscillatory current from Leyden jars : "It would seem probable therefore that when such discharges of high frequency pass through the body, that, owing to their *high current strength*, as well as to their high frequency, powerful physiological effects may be produced."

The author's view of X-ray burns is original, ingenious, and of considerable interest. He maintains that they are not X-ray burns at all, but a result of the action of heavy currents used in generating the X-ray. He is mistaken, however, when he says : "None of the alleged injurious effects of X-rays . . . is caused by the static current." (By the way, is it not time that the term "static current" (!) disappeared from electro-therapeutic nomenclature ?) That "these electrical or heat effects which resemble sunburn" may be caused by the static, we are told on p. 88, and a bad burn *has* been caused, where the Crooke's tube was excited by a small Toepler machine, turned by hand. It would be interesting to know whether such burns have ever been observed in the absence of Crooke's tubes—at an electric power station for instance. If so, it would corroborate the author's view.

But enough—the criticism we would make is that a work which should have taken at least one year, or even two would have been better, to prepare, was written in about three months. A herculian performance to be sure, but at the expense of accuracy and clearness.

Lectures on the Treatment of Fibroid Tumors of the Uterus, Medical, Electrical, and Surgical. By Franklin H. Martin, M. D., Professor of Gynecology, Post-Graduate Medical School of Chicago; Surgeon Woman's Hospital of Chicago. Author of "Electricity in Obstetrics and Gynecology." Chicago: The W. T. Keene Co., 1897.

The author, so well known from his writings on gynecological subjects, has brought together in one small volume a number of lectures on the subject of fibroid tumors. Beginning with the gross anatomy and pathological changes, he divides the subject into various classifications, such as interstitial, intramural, subperitoneal and submucous. After explaining these divisions, he describes the histologic changes, and discusses the ætiology.

The book, however, is a book on treatment. Every known method of treatment of fibroid tumors is carefully discussed, giving full weight to all the claims of the physician in the medical, the electrician in the electrical, and the surgeon in the operative treatment. Of course one would expect a very careful and complete résumé of the electrical treatment from Dr. Martin. His pen has been active along this line for many years; he has not only done much practical work, but has added numerous new instruments for the treatment of fibroid tumors. There are but few books extant which cover the subject more thoroughly than the one before us. The book is written evidently for gynecologists, and from a gynecological standpoint.

A PRACTICAL WORKING HANDBOOK IN THE DIAGNOSIS AND TREATMENT OF DISEASES OF THE GENITO-URINARY SYSTEM AND SYPHILIS; Being the Revised and Enlarged Notes with Additions, by GEORGE PARKER HOLDEN, M. D., of Clinical Lectures Delivered in Flower Hospital Amphitheater by F. E. Doughty, M. D., Professor of Genito-Urinary Diseases in the New York Homeopathic Medical College. Philadelphia: Boericke & Tafel, 1897.

There is generally a prejudice against books made up of clinical lectures from a stenographic report. It is natural that there should be, as the reporter does not grasp the full meaning, as a rule, as does a writer, and a man speaking extemporarily is not liable to give as full details as when he sits down to write carefully. This work, however, is a grand exception. Not only are the lectures very complete in all details, but they are reported in the lecturer's own language. They comprise didactic teaching, clinical reports, description of operative procedures, medication, and technique of procedure.

The book contains 440 pages, and is full of interesting and instructive matter from cover to cover. In fact, it is hard to conceive of a book with a less amount of padding. The first of the book is given up to the armamentarium, then begins diseases of the bladder, and this department is followed by diseases of the prostate, and so on until the entire subject of the genito-urinary disease is covered. Dr. Doughty is so well known as a teacher that no words of commendation of ours is necessary. Dr. Holden has made his appearance in medical literature under most favorable auspices, and may he continue to serve up mental pabulum of equal merit either as an editor or an author!

EPITOMES.

ELECTRICAL TREATMENT OF ENURESIS.

Koester advices having the patient empty the bladder and lie down at full length on a sofa. Attach a medium-sized round electrode to the anode of a faradic battery and place it upon the abdomen over the region of the bladder. Disinfect the cathode (sound or bulb), and insert in urethra from 1 to 1.5 cm. Turn on the current gradually to the point where the patient can bear it with comfort. Allow to pass for from two to three minutes, then gradually weaken the current to its lowest power, and let it continue for one minute. Repeat this procedure three times and treatment should be ended. This often makes a cure ; but it is better to "repeat it a few times during the following three or four days."

An application should be made the day after the bed or clothing has been soiled, otherwise the treatment should be discontinued.—*Charlotte Medical Journal.*

ELECTROLYSIS OF SMALL GROWTHS.

BY HOMER C. BENNETT, M. D., LIMA, O.

Dr. Bennett says that the removal of small growths by electrolysis is "quick, safe, painless, aseptic, bloodless, and leaves very little or no scar, and is the ideal and most rational method."

The doctor has removed corns, warts, moles, hemorrhoids, papillomata, nævi, epithelioma, condylomata, superfluous hairs, osteomata, etc., by this method.

If the patient is nervous, and especially in women and children, use cocaine locally, either externally or subcutaneously. Insert one or more needles, held firmly in a suitable needle-holder electrode, well under the base of the growth, so as to be sure to get it all ; then connect the electrode with the cathode of a galvanic battery. Apply the anode to some indifferent part of the body. Now turn on the current gradually until minute bubbles appear around the needles ; let an even current flow from three to thirty minutes, according to the density of the tissue and the extent of the work to be done. Shut off the current, withdraw the needles, reintroduce them in right angles to their previous position, and turn on the current as before. If carefully done, the growth blanches at once, turns black in a few days, dessicates and falls off, leaving a healthy surface, that heals without a scar. The only dressing needed is an ointment of the yellow oxide of mercury. Always allow nature to cast off the blackened tissue.

HYPER-SENSITIVENESS OF THE VAGINAL MUCOUS MEMBRANE.

BY S. H. MONELL, M. D., BROOKLYN, N. Y.

A large number of the ordinary cases who visit the office of the medical gynecologist are found to be sensitive to a first examination. From a variety of causes the mucous membrane may be in a state of genuine hyperæsthesia, or the neurotic state of the patient and the fear that she is about to be "hurt" may make a digital examination exceedingly disagreeable to both physician and patient.

It sometimes happens that a physician who ignores sentiment in the matter loses a patient, for some women dread a rough manipulation more than they fear the average pelvic disease. From the history of the case and the general observation, it will readily be seen whether or not there exists an actual necessity for a complete examination and diagnosis before any attempt at treatment is made. In ninety-nine cases out of a hundred the office patient does not stand in need of a digital or bi-manual examination at the first visit, if there is either a sensitive condition of the mucous membrane or a neurotic state to oppose it.

It is in the management of the early treatment of this class of cases that the practical resources of a high tension induction coil apparatus becomes an indispensable part of the physician's equipment. By so simple a remedy as vaginal bipolar faradic sedation from the exquisitely smooth, painless, soft, and agreeable current from the author's coil apparatus (made by the J. Kidder Manufacturing Co., N. Y.), the physician is able to accomplish two steps of preparatory treatment at once. If the intolerance to digital touch is merely emotional or hysterical, the sedative application will entirely compose the nervous fears of the patient. It is a general sedative tonic remedy which calms the entire system.

If the hyperæsthesia is due to congestion, vaginitis, excoriating discharges, or any grade of simple inflammation of any of the pelvic tissues, the bipolar application is the best possible treatment that can be given, and no examination will add to the benefit of the patient until the acute irritability is allayed.

So large a number of patients require one, two, or more of these preliminary sedative administrations to remove temporary impediments to other local treatment, that the improved coil apparatus, which is by no means expensive, would be indispensable on this account alone ; but it also possesses all the qualifications which cover the entire range of therapeutic action of both the types of current which are called "faradic" and "sinsusoidal." The common faradic battery, even though it is supposed to be a very fine affair, and may often cost fully two-thirds as much as a proper apparatus, is limited in its usefulness to external applications, and the more gross forms of nerve and muscle effects. It cannot enter the finer field of therapeutic action in which the scientific electeo-therapeutist does his most satisfactory work, while on the other hand the high efficiency battery is not limited in its scope of action to any one branch of practice, but performs all the work of induction coil currents of every variety—"the greater includes the less."

In employing the bi-polar electrode it is necessary to understand the correct regulation of the dose and how to maintain the electrode in proper position within the vaginal cavity. Knowledge on these two points is essential, but there are no exacting demands for operative skill.

Simply warm the electrode to about blood heat, lubricate the tip with a little plain vaseline, and it can be gently inserted with satisfactory comfort into the most sensitive mucous tissues, even when they are acutely inflamed. It can be completely inserted deep into the cul-de-sac when the tip of the finger cannot be passed through the vulva without causing the patient to exclaim and protest. Always connect the positive pole with the internal half of the electrode (the tip), and connect the outer half with the negative. There is no variation from this rule in the use of the vaginal bipolar faradic electrode.

In regulating the dose through any of the secondary coils of the apparatus do not make the mistake of directing the electrode so that it affects the muscles of the legs and causes them to contract or sends a tingling sensation even to the very toes. In this case not only will the current be deflected from its proper sphere of action, but it will be impossible to employ a current strength which will successfully treat the pelvic tissues. A little knack in maintaining the electrode in the cavity in a proper relation to the parts so as to avoid contracting the muscles of the leg is the most elementary part of the method, and each operator must practice it a few times. Anyone who can successfully insert a speculum or a tampon can master all the difficulties of one of the most valuable methods at the command of the general practitioner.—*Times and Register.*

GALVANIZATION OF THE PNEUMOGASTRIC IN ANACHLORHYDRIC DYSPEPSIA.

BY DR. BARADUE.

The galvanization proposed by the author in dyspepsia is, first, cervico-gastric. It acts on the pneumogastric nerve and the nervous layer of the stomach ; second, direct gastric application when symptomatic hypopepsia exists.

CASE I. Hypopepsia from functional trouble. N. T., sick for thirteen years, consulted Baradue.

There existed stomach dilatation with hypopepsia, loss of appetite, what was eaten was not digested, cramps and palpitation of heart, hyperæsthesia of the solar plexus, emaciation considerable. A month's treatment of pneumogastric galvanism immediately after each meal showed re-established digestion and absence of the cramps, the normal acidity of the gastric juice restored. The faradization was continued for another month. A year afterward the patient was in good health, had gained twelve pounds in weight, digestion was normal.

CASE II. M. D. was taken with pain at top of head following mental worry. The pains gradually extended over the head, neck, chest, and stomach. The duration was sixteen years. The patient was emaciated. There was a painful spot over the lambdoidal suture, pressure over the neck on the pneumogastric is painful as well as over the lower cervical ganglia. The heart beats slowly, sharp pains over the epigastrium, pain on pressure over the fourth dorsal vertebra, two painful points over the ganglions of the solar plexus. The neuralgia is therefore accompanied by (double) neuralgia of solar plexus. Treatment by galvanism was decided on, both for the purpose of stopping the vomiting and for producing a normal gastric function. The sitting was conducted in this manner: The patient took a little beef tea, which, under the influence of the galvanism, was retained. The exalted muscular reflex was quieted. After the third sitting the stomach was less painful, the reflex was established, and the muscular spasm was diminished, the vomiting stopped and diarrhea supervened, indicating irritability of the intestine. This disappeared and the patient went on to state of health.—*La France Med.*

INFLUENCE OF INDUCED CURRENTS ON THE LOCALIZATION OF LIVING BACTERIA.

BY DR. L. LORTET.

Living bacteria, in the form of motile bacilli, are extremely sensitive to the action of induced currents. They are the only organized elements the localization of which is influenced by such currents, and this in the direction of the current.

This property of bacteria is not only physical, but is in direct relationship with the vitality of their protoplasm, for, as soon as an antiseptic liquid has immobilized or killed these bacteria, electricity has no longer any effect upon them.

ATTENUATION OF VENOM BY ELECTRIC CURRENTS OF HIGH FREQUENCY.

DR. PHISALIX: From researches which I have carried out it appears that venoms behave in respect of electric currents exactly in the same manner as toxins.

Viper poison which has been subjected to currents of high frequency may be injected into guinea-pigs without determining the least ill effect. Moreover, animals into which this poison treated by electricity has been injected are vaccinated against the inoculation of the same venom in its natural state. This immunization lasts at least seven days.

PROFESSOR D'ARSONVAL: In the experiments made by Dr. Phisalix, as in those which I have carried out in collaboration with Dr. Charrin on toxins, every precaution has been taken to prevent a rise of the temperature, in order not to introduce a disturbing element in the experiments and vitiate the result. —*Biological Society.*

TREATMENT OF PROSTATIC HYPERTROPHY AND RETENTION BY CAUTERIZATION THROUGH THE RECTUM.

Negretto (*Gazz. degli Osped.*) records four cases of prostatic retention treated with much success by the above method. After thoroughly emptying the rectum the patient is anæsthetized and a rectal speculum passed, the upper part of the bowel is plugged with gauze, and then, under the guidance of the finger, a specially devised hook with graduated stems is passed into the prostate to steady it. The prostate is then cauterized with a Paquelin or galvano-caustic over the extent required. The operation only lasts two minutes. The bowels are kept confined for a few days, and a catheter kept permanently in the bladder for some time. On the sixth or seventh day a purge is given, and at the end of ten or twelve days the catheter is removed, and the patient can urinate by himself. The patients were 56, 62, 74, and 78 respectively, and had suffered from prostatic disease from three to five years on an average. In each case cauterization *per rectum* not only speedily relieved the congestion, but caused a notable diminution in the size of the prostate. The author believes this method to be superior both in its immediate and remote effects to castration or excision of the vas deferens.

ELECTRICAL MISCELLANY.

—S. H. Monell, M. D., in the *Times and Register*, says that tin makes a good "non-attackable" electrode within the uterus. A positive current below 75 ma. will not affect it. Under such circumstances it will take the place of the costly platinum electrode.

—The American Therapeutic Company, New York, offers a prize for the best report of cases treated with Carnogen. It will consist of a Reichert's hemoglobinometer, a Thoma-Zeiss corpuscle-counter, Cabot's "Guide to the Clinical Examination of the Blood," and von Jaksch's "Clinical Diagnosis." The conditions of the contest will be made known on application and mention of this journal.

—A prominent Vermont physician, writing to thank the Imperial Granum Company for copies of their famous Clinical Record, adds the following convincing words as to the merits of their product as a food for children: "I can show a baby that has been reared on Imperial Granum—after trying numerous other foods until he was reduced to a mere skeleton—that is now as tough and strong a boy of fourteen months as can be found anywhere."

—In a former issue of this journal appears an article by Jennie W. Martine on "Dilating with Faradism." In using this method she states that the coil must be of *particularly fine wire and more than the* USUAL *length.* Comparatively few physicians who use faradic batteries are informed as to the number or length of the fine wire used in the coil. There may be a "usual" length of wire; but my experience leads me to believe that there is no regularity either in length of wire or size as between the batteries of different makers. It seems to me that it would be a good plan for the manufacturers or physicans, or both, to get together and agree upon some length and size as being *regular.* Any departure from this could be noted, and physicians in giving their experience would be able, to this extent at least, to convey a more accurate idea of the character of their electric work. For myself, I would like very much to know the length and number of the wire Dr. Martine would recommend in operations of the character mentioned in her article.

L. H. BRADLEY, M. D., Merced, Cal.

—Veyrier recommends the faradic treatment of fibroids. Tripier's indications for faradization of the uterus: "Inaccessibility of the cervix; when pain is the predominant symptom; when it is desired to induce the delivery of a pedunculated submucous fibroid." In the first case it is effectual without the electrode requiring to enter the cavity of the uterus. Where ergot has failed, faradism has often been found to hasten the expulsion of the uterine contents. The sensibility of the patient determining the strength of current. The indifferent electrode is of nickeled copper, covered with a thick layer of gauze, which is placed upon the abdomen. The active electrode is applied through a Fergusson's glass speculum and rests upon a wad of moist wool at its upper end, reaching to the cervix. The Apostoli bipolar electrode is also of great service. The active electrode may be inserted into the uterus, if possible. No chemical effect should ever be produced by the current. The seance should not last over fifteen minutes. Lest the sedative effect that has been gained lead to imprudent exertion, the patient should remain in a recumbent position the rest of the day. The value of this method is illustrated by nineteen cases, three of which are original.—*Arch. d'Elect. Medicale.*

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ORIGINAL ARTICLES.

NEURASTHENIA AND ITS TREATMENT BY ELECTRICITY.

BY CHAS. PORTER HART, M. D., M. E., WYOMING, O.

Neurasthenia may be general or local, true or false, cerebral or spinal. These various forms are distinguished by certain characteristic symptoms, the recognition of which in any particular case is, in my opinion, as essential to its correct and scientific treatment as it is to its true diagnosis.

Permit me, then, my fellow-members of the National Society, to point out, I trust without offense, first of all, some of the distinguishing features of the different forms of a disease which, so far from being one-and-the-same under all circumstances (as the name itself would imply), is as multiform in its various aspects as is the protean malady so often mistaken for it, namely, rachialgia or spinal irritation.

True neurasthenia is distinguished from the spurious by the *fixity* and *permanency* of the accompanying pains, whether local or general, and the same is true of the attendant weakness or debility, especially when these symptoms are much more pronounced in the erect or semi-erect position of the patient than when he is in the recumbent position.

On the other hand, false or spurious neurasthenia includes the various hysterical and sympathetic forms, so called, the irritative or rachialgic, the transient and the migratory. The true forms are always central in their origin or seat, the spurious eccentric or peripheral.

Having distinguished the true from the false in these cases, there remain to be considered the symptoms belonging to the cerebral, the spinal, and the cerebro-spinal forms. It is wholly unnecessary for me to so much as even mention the characteristic symptoms of these several conditions, as they are well known to you all. Suffice it say, by way of reminder, that they belong in each case to that portion of the central nervous system governing the impaired or disturbed functions manifested in each particular case, whether general or local—the cerebral and cerebro-spinal being the more general, and the spinal the local forms, such as the cardiac, the dyspeptic, the genital or sexual, etc.

Now, as to treatment. A review of our principal authors on the subject shows that almost every leading practitioner has his favorite method, while the kinds of electricity employed appear to be about equally divided between the three forms, the galvanic, the faradic, and the static.

A brief *résumé*, based chiefly upon the report prepared by Dr. Régnier of Paris, may not be out of place, as even the past, with its numerous errors, is, in the light of later experience, full of instruction, especially to the novice.

Thus, Beard and Rockwell claim that in their hands the general or central form of neurasthenia yields best to central galvanization and general faradization, practiced after the following manner: The negative pole of the continuous galvanic current is applied by means of a large electrode to the epigastrium, the positive pole, represented by a large round sponge, being placed successively on the head, then over the sympathetic and pneumogastric nerves, and afterward moved over the whole central nervous system. With a feeble current, furnished by two to eight elements, the electrode is first passed over the surface of one extremity or the other, then over the center of the cranium near the vertex, on a line corresponding to the level of the two ears, for a period of one or two minutes. The positive pole is afterward moved slowly down each side of the neck over the course of the pneumogastric and sympathetic nerves. Afterward it is applied in the same manner from the top to the bottom of the vertebral column during three to six minutes, the application being deemed especially important over the region of the neck.

These authors practice faradization by traversing the head longitudinally, the positive pole in advance, and the negative at the top of the neck. Sometimes they vary the treatment by placing one pole to the head and the other under the feet. For general faradization, they strip the patient and place him on an insulating stool, the feet resting on a large electrode or in a basin of water, which they join to the negative pole of the coil. The positive pole is connected with a thick sponge electrode of from five to eight centimeters in diameter, which is successively applied to all parts of the body. First they pass a notably sensible current by means of one of the electrodes in front of the temples; this electrode is afterward moved to the vertex, where the pole is allowed to rest a certain time, then with a little stronger current, it is made to traverse the occiput and the nucha. Increasing the strength of the current still more, the electrode is passed downward over the vertebral column, especially over the vertebræ inclosing the spinal cord. Then comes the faradization of the neck with a feebler current, for the purpose of exciting the great sympathic, pneumogastric, and phrenic nerves. Afterward they faradize the anterior region of the chest on the level of the heart, and then, with a more energetic current, the abdomen. Placing the electrode over the epigastrium, in order to affect the cœliac plexus, they afterward pass it slowly over the whole abdominal parietes, in order to excite the intestinal walls and the abdominal muscles. They end the séance by an energetic excitation of the muscles of the four extremities, by strongly pressing the electrode over the course of the principal nervous trunks, in such a manner as to provoke the most energetic muscular contractions, both in the limbs and all other parts of the body. The usual duration of the treatment is from ten to twenty minutes. They claim for the treatment the following results:

1. An immediate general refrigerating and tonic action.
2. The following durable effects: Improvement of sleep, increase of appetite, quickening of the circulation, greater facility of digestion and defecation, increase in the size and consistency of the muscles, lessening of pains, of morbid susceptibility, sense of pressure in the head, and of nervous and mental depression; also, that the intellectual faculties are awakened, and the patient regains the desire to live.

I have given Beard and Rockwell's treatment pretty much in full, because it has been so often imitated by others, and frequently with but very slight modifications.

Thus, Dr. Weir Mitchell adds to his multitudinous forms, general faradization very much after the same fashion, but, as he himself explains, from lack of experience he uses only feeble currents. He however utilizes slow interruptions of the current, two to five per second, which he regards as an improvement. He thinks that more rapid interruptions by an operator knowing well the points of Ziemmsen would result more satisfactorily than the mild currents and slow interruptions employed by him.

What is most peculiar about his mode of treatment is the placing of the moistened sponge-covered electrodes in tiers, or rows, one after another in succession over the surface, so as more thoroughly to cover the various muscles, at a distance of six to eight centimeters, moving the poles upward in tiers from the lower extremities to the abdomen, then the chest and arms, and lastly the sides of the face and neck, the whole operation lasting from forty minutes to an hour. The result, even in the opinion of the author, does nôt appear to have been very brilliant, though it is interesting to observe that the faradization of the muscles in this manner during one-half hour gave a thermic elevation varying from ½° to 1° Fahr. This elevation disappeared in from one to two hours. Central faradization had less effect in raising the temperature, so that the author's inference seems justified, namely, that the electrical, like the natural, exercise of the muscles, increases the heat of the body.

Hutchinson, who also employs central galvanization and general faradization in neurasthenia, prefers the latter to the former when used singly, but sometimes combines the two in treatment of the muscles. In using the galvanic current, he advises an intensity of ½ ma. to 1½ ma.

Erb, who says he has had but little experience in the treatment of these cases, advises traversing the head both longitudinally and transversely, with a feeble galvanic current, but Bonnefin regards even a feeble current in this manner as somewhat risky.

According to Régnier, Rumpf is said to have obtained good results among very depressed neurasthenics by stimulating the skin with the faradic brush. He recommends beginning with very feeble currents and short séances, as such patients are very irritable. When the séance is well borne, he increases the strength of the current little by little. Notwithstanding this, however, such is the sensibility of these patients, it sometimes happens that reaction is produced within three or four days after beginning the treatment, inducing such symptoms as pains, vigorous surexcitation, aggravation of the headache and insomnia; and he adds, the physician ought to be sure that he has the disease under his control before risking a procedure where good ought always to follow, and is apt to be attended with such inconveniences.

The *rigid polar method* is followed by Lowenfeld. In cases of congestion, he applies the positive pole to the seat of the trouble, and in cases of anæmia, the negative. Sometimes, he says (but without specifying the indications), it is well to employ successively both directions of the current. He also advises to place a large electrode on the head and another to the feet, and to carry out the above indications as to congestion and anæmia by placing either the positive or the negative pole on the vertex as the case may require. In this, as will be seen, he follows Holst and his disciples.

Such, according to Régnier, was the general line of practice in these cases up to the year 1890, when Dr. Vigouroux introduced the treatment of neurasthenia by franklinization. In this the electrostatic bath formed the basis of the treatment. The patient was placed on an insulating stool connected with the negative pole of a powerful static machine. In this way the patient was charged with electricity of a very high potential, the discharge taking place through all the channels of the body and investments.

Vigouroux found the action of the bath to be notably sedative. The duration of the treatment varied from fifteen to twenty minutes, according to the subject. The souffle, directed to the head by means of a metallic point, is sometimes added to the bath in order to dissipate the sensation of pressure which appears after the lapse of a few moments.

The sparks are employed by the author whenever the patient is attacked with paresis, parieto-visceral prolapsus, or gastro-intestinal atonia. He also utilizes them to produce a revulsive reflex action by cutaneous irritation.

When well borne, electrical friction, according to this authority, plays a grand rôle in the treatment, by its local stimulating and its sedative reflex action, and also as a stimulant to the general nutrition. Vigouroux speaks very highly of this treatment in general neurasthenia.

According to Régnier, some electro-therapeutists prefer the douche to the electrostatic bath, given either with the pointed disk of Baraduc suspended some centimeters below the head of the patient, or with the web of Truchot, or with the pointed disk of silver or aluminium, or with whisks of dog-grass, these two last means possessing, according to them, a very energetic sedative action.

Dr. Régnier, whose experience in these cases has been very great, says he believes that the electrostatic douche is more efficacious than the simple bath, and its employment more commodious than the bath with the souffle directed to the head by the aid of the point, as in the procedure of Dr. Vigouroux.

He adds that franklinization since 1890 has been adopted by the majority of electro-therapeutists, either singly, or combined with internal medication (Régis, Vigouroux), or with hypodermic injections of glycero-phosphates (Imbert de la Touche), or with galvanization (Fovean de Courmelles).

My own treatment in these cases has been limited to central galvanization and general faradization, combined with internal treatment per ora, and hygienic influences, such as fresh air, moderate exercise, and, whenever practicable, an ocean voyage, exposure to mountain or sea air, and, in some very bad cases, a complete change of climate.*

The spinal form of neurasthenia seldom involves the whole spinal tract, but is generally limited to certain focal points, or centers, which give rise to the varieties known as cardiac, dyspeptic, sexual, etc.

The cardiac variety is almost always associated with the dyspeptic, and hence most authors have derived most benefit from treatment directed against the latter.

Dr. Régnier, whom I have so often quoted, gives such an excellent *résumé* of the various treatments of the best known authors on this subject, that I cannot do better than follow him in his report. He says,* in giving his own experience, "in the spinal form, labile galvanization down the cord, the negative pole resting on the sacrum, the positive moved along the vertebral column from the base of the cranium as far as the last dorsal vertebra, appears preferable to faradization. The static sparks and electric friction of the inferior half of the body rapidly lessen and cause to disappear the signs of spinal congestion, such as the spasmodic state of the muscles of the inferior extremities, the cramps, the reflex exaggerations, and seminal losses.

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*See "Nervous Therapeutics," by the author, p. 13.

"The dyspeptic form of neurasthenia is the most frequent of all. This is the general opinion of all the authors that we have consulted. We here find many more methods recommended."

Beard and Rockwell commence by general faradization, then, if this is not sufficient, they proceed to galvanize the pneumogastric and sympathetic nerves in the neck, and later, in case of check, have recourse to central galvanization.

Leube occasionally employs strong faradic currents which he passes from the back to the epigastrium; sometimes he applies the galvanic current externally, the positive pole to the epigastrium and the negative to the dorsal vertebræ, with very strong currents. The internal application, with the electrode in the stomach, does not appear to him to increase its efficiency.

Burkart claims good results from his practice, which consists in making (by energetic pressure of the positive pole in the region of the abdominal plexus) sensible to the pressure, the negative pole being placed on the back.

Stein prefers the faradic current of mean strength, which passes from one hypochondrium to the other by means of large electrodes.

Richter and Kusmaul have also verified the good effects of faradization of the abdomen. Erb, while saying that he has no personal experience on the subject, would at first try faradization. If there are abnormal sensations during digestion, or if hyperæsthesia of the nerves of the stomach predominate, stabile galvanization is indicated, the positive pole applied on the epigastrium. He thinks it necessary at the same time to make general treatment.

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* See the *Official Bulletin* of the French Society of Elec.-Therap., 5° Ann. No. 7, p. 147 *et seq.*

When there is dilatation of the stomach, Onimus recommends ante-posterior stabile galvanization from the epigastrium to the back and from the small to the great curvature. Leube gives similar advice, Erb and Furstner prefer faradization. One electrode is placed to the left hypochondrium ; the other, on the epigastrium, is moved with strong pressure from cardia to pylorus. The current ought to be energetic.

Neftel places the electrodes on two opposite points of the dilated stomach and passes from ten to twenty times per minute progressively stronger currents, or better, very strong currents renewed every few seconds fifteen to twenty times.

Oka and Harada place the positive pole in the cardiac region and move the negative pole over the stomach, pressing it in at intervals. The séance lasts ten minutes and ought to be made before the principal meal.

Erb recommends placing a large electrode on the back, against the left spinous apophyses on the level of the cardia. At first he touches the cardia with a smaller electrode, then all the other points of the surface of the stomach. The currents ought to be strong ; the duration of the séance from five to eight minutes. The séances should be made every day, by preference after washing out the stomach.

De Watteville has advised galvano-faradization, the secondary coil of the induction apparatus being inserted in the circuit of the galvanic current in such a manner that the current of overture shall follow the same direction as the galvanic current. The action excited by the faradic current thus manifests itself on all sides, where it produces a modified action of the galvanic current, and, as the negative pole augments the excitability, the action of the faradic current is increased. After electrization of the stomach, one may proceed to the galvanization of the sympathetic and pneumogastric nerves in the neck, and also apply the current in the region of the point of emergence of the splanchnic nerve, between the fifth and the tenth dorsal vertebræ.

Hutchinson combines galvanization and faradization. General galvanization is made, following the method already described, with an intensity of 1½ ma. during twenty minutes in the morning. In the evening, as late as possible, he proceeds to faradization with one electrode placed on the sacrum, and the other moved successively over the trunk, the kidneys, and the limbs with a feeble current. In ten minutes the séance is terminated, and soon after the patient is in bed for sleep. The electric treatment, according to this authority, ought to be aided by a severe diatetic regimen.

Batton Massey, Dr. Régnier's colleague at La Charité, and a partisan of what is styled sympathetic pathogeny, recommends stabile galvanization by the aid of large electrodes, the indifferent on the back, the active, from six to eight inches in diameter, on the abdominal region. The intensity recommended is from 50 to 150 ma. For the peripheric applications he gives the preference to the galvanic current, the indifferent electrode to the back, the other, of three centimeters diameter, on the motor points, with intensities from 15 to 35 ma.

Vigouroux recommends franklinization, by drawing sparks from the region of the stomach and the left iliac fossa. Baraduc employs internal franklinization of the stomach by the aid of a sound terminated at its external extremity by a bulb that the operator holds in the hand, the patient being placed on an insulating stool connected to the negative pole of the machine.

Dr. Régnier says that he has had very good results from the oscillating process of franklinization already described. It is the process, he says, to which, by experience, he gives the preference, after having tried galvanization and faradization.

The above compilations are sufficient to show the various methods adopted by the leading electro-therapeutists in the treatment of the two principal forms of this most stubborn of all functional diseases of the nervous system. For this reason, I will not weary you with the slightly modified processes they have adopted in other local forms of the disease, such as the sexual, since the principles are the same in all.

I will therefore close this somewhat lengthy review, by giving the conclusions reached by our principal authority, Dr. Régnier, chief of the Laboratory of Electro-Therap. of La Charité at Paris:

1. In general neurasthenia, galvanization, faradization, and franklinization give equally good results.

Franklinization under form of the electrostatic douche seems the process of choice on account of the facility of its application, and of the absence of those inconveniences which operate unfavorably in galvanization or faradization among very sensitive subjects, as are the majority of neurasthenias.

2. In spinal neurasthenia, other than the purely local, without calling in question other processes, galvanization or electric friction of the inferior half of the body appears to us the best means.

3. In the dyspeptic form, galvanization by the process of Batton Massey and franklinization by the process of Baraduc are those which in my judgment ought to be adopted.

4. In the genital neurasthenia among men, we seriously advise associating the electrostatic douche with galvanization or local faradization. Among women uterine or vagi-

nal faradization, associated or not with the electrostatic douche, is the best process.

5. In the more local forms, franklinization by the souffle is indicated by preference to other means of electrization.

To the above conclusions of the learned doctor, I would add the general utility, in all very stubborn cases, of aiding the electrical treatment by such hygienic measures as I have already pointed out, namely, change of air, an ocean voyage, and, if necessary, a complete change of climate, not neglecting even the matter of diet.

CAUSES OF FAILURE.

BY N. B. DELAMATER, M. D., CHICAGO.

In looking over some of my old records for the purpose of selecting a subject for this paper, my attention was forcibly called to the many failures in my early years of practice. This in strong contrast to success, even brilliant results, in cases as nearly identical as I can determine.

You will, I know, pardon a little personal allusion to myself. In my college course I was much interested in physics, particularly electro-physics. This interest was developed after my graduation by circumstances. I was thrown in contact with the officers of a large electrical manfacturing concern and spent a considerable time in experimentation, examining new ideas and appliances, and the like. I tell you this that you may see that I started the use of electricity as a therapeutic agent with a fair knowledge of the physics of the subject, and this I believe to be an essential element to success. I do not believe any man can get good results who is not fairly well informed in the physics of the subject. But this was not the cause of my failures, evidently.

The next question to present itself, and a very important one it is, and one that I sincerely hope and trust will have a very different answer in the next twenty-five years, was: Were my failures due in the main to the fact that too little was known of electro-therapeutics? This might, and I think did, account for a few of them, but by far the greater number could not be accounted for in this way, for the same application has in later years replaced failures with success. The conclusion is plain that there must have been some cause outside electrical knowledge, either as to physics or therapeutics.

It seems to me that the first and prime cause was the undertaking to use this as a routine remedy, to make of it a cure all, and in some cases, I am ashamed to acknowledge, to make it a something to impress the patient. I am thankful that I do not have to accuse myself of the sin of using it for the special purpose of increasing my income.

The failure to study the case with a view as to whether this remedy could be of avail is the first cause of non-success. I freely admit that often the report from physicians or laymen as to what had been accomplished by this remedy, even in the hands of the unskilled and ignorant, caused me to reason that I could not tell without trying whether it would help certain cases or not. But there were a large number of cases in which I now know this remedy must necessarily have proved absolutely useless, and in which, with a studious use of the knowledge I then possessed, I would have known that I was wasting time in using it. I formed a tendency to loose methods of diagnosis; a feeling crept into my mind that this agent would relieve or cure, and consequently I did not take the same care in diagnosis. For instance, electricity has been for many years (and is to-day) one of the very best remedies now known for constipation, but there are many cases of constipation where surgical interference is absolutely essential to a cure, or where medicine or diet, by correcting certain digestive or chemical disturbance, is the only means of cure. By careful study and accurate diagnosis, and then by correctly answering the questions, What must be accomplished in order to cure this individual constipation? and How or what will accomplish this? I am able frequently to rule electricity out. The result is that my percentage of cures to entire number of constipations treated is much greater, and the percentage of cures to entire number treated by electricity is also much greater.

In case of paralysis a careful analysis of my case enables me many times to recognize the fact that, while the current in some form will be an invaluable aid, yet it cannot accomplish all, and that other means must be employed for the cure of certain elements of my case. I used to make many failures from a feeling that this was the remedy *par excellence* for paralysis, whereas it is more frequently only an adjuvant, a valuable one—I may even admit a necessary one—in the treatment of the one symptom paralysis; but the real condition, of which this paralysis is only a prominent symptom, must be cured, if at all, by other means. So we might go on through a long category of diseases and conditions, but I think this is enough to make my point clear.

Another source of failure was in the constant tendency to give routine treatment, making applications almost identical in a very large number of cases, instead of making the method subject entirely to each individual. In order to break myself of this I adopted the plan of studying to make no two alike in method. Then came the electric bath, chair, and other devices, all of which tend to simple routinism. I now recognize that all these things have a place, but are dangerous to the success of a beginner on account of the routine tendency in them.

Another source of failure was an insufficient study and care as to the kind of current used in the individual case. I now select the static, the galvanic, the faradic, the sinusoidal with as much care as though they were entirely different remedies. I do not want to be understood as saying, or even thinking, that I have attained to so perfect a knowledge that I can infalliably select that current which is best adapted to the case, for I not infrequently find I have made a mistake, but that by careful study I endeavor to select what is best for each case.

In this connection I want to call attention to the matter of fitting the strength of current, the duration of application, the direction, and all other details to each individual case.

I am not certain but that I ought to apologize to so learned and scientific a body for so simple a paper; for calling attention to nothing that you do not know fully, but I so constantly meet my own former mistakes in others that it seemed to me not amiss to make an effort to impress fully on your minds, not only the necessity for great care in your work, but for the insistance, in season and out of season, by you in your teaching, on that careful scientific study and attention to detail without which success cannot be obtained.

A CASE OF INTRA-UTERINE FIBROID.

BY BESSIE P. HAINES, M. D.

Miss S., age forty-four, unmarried. A teacher in our public schools. Six years ago she had a fall, striking upon the right side. Soon after, discomfort was felt in that locality, and about three years ago the growth was discovered.

The pressure had become so great from its position that she appeared a nervous wreck, otherwise she looked strong and robust. She had never had electricity suggested to her, but was willing to try it. There had been no hemorrhage.

I gave her the faradic current, placing the positive pole against the tumor (per vagina) and the negative upon the abdomen, increasing the current gradually to a point of *agreeable* tolerance, treatment lasting thirty minutes. She was relieved somewhat at the first treatment.

These treatments were continued three times a week, with one electro-vapor bath once a week. At the end of the second month she appeared in perfect health, and no one would have supposed that she was otherwise than well. The tumor had decreased one half in size.

I then became ambitious to remove the growth entirely, having read of such pronounced success in that line by means of galvanization. I felt confident that I would meet with as favorable results, and began using the galvanic current, giving from 50 to 60 milliamperes, feeling that that was very modest considering the recommendation of 150 milliamperes by the best authorities. These were given twice a week, placing the negative pole at tumor, and the positive upon the abdomen, treatment lasting from five to seven minutes. In about two weeks she informed me that she would take no more treatments from that battery as she was then where she was in the beginning, and this proved to be the case. I knew she was not improving, but hoped that a change for the better would soon take place. I was doomed to disappointment, as the growth had increased in size, and, all from aggravation, had returned. While the improvement was marked under the faradization, the reverse was equally so with the use of the galvanic current.

I know that but little is claimed for the faradic current in these cases, but the result I obtained must have credit. Whether I could have removed this growth had I continued as I began, and been given time, is a question which none of us can answer. I believe I could. She was obliged to return to her home, and reports herself comfortable.

I regret that I cannot hear the discussion upon this case, for it was written with the hope that my failure might be explained by those who are farther advanced in electro-therapeutics than I claim to be.

I believe that in the near future we may be able to overcome these conditions when they arise before us as successfully and as readily as we have many others just as serious.

I have cured two cases of hay fever by the central and general faradization.

If you have not used it, give it a trial. One case responded to *one* treatment.

Mrs. D., age twenty-six, married. At the fourth month of her first pregnancy she miscarried without any apparent cause. The uterus was curetted to prevent a second miscarriage should she become pregnant again. A second miscarriage at three months was the result, with the above treatment repeated every three months until three operations had been performed. Two years after the last one she came to me for treatment. She had a muco-purulent discharge from the uterus which had been constant and copious for two years. She was almost a nervous wreck.

I used both faradic and galvanic currents in her case—the faradic one week, and the galvanic the following week, as I felt the situation demanded. I discharged her at the end of the third month. She is to-day in better health than ever in her life.

Mrs. S., age forty-three, married. A case of uterine hemorrhage of one year occurring every fifteen days.

Subinvolution—the uterus measuring 6½ inches. I gave the faradic current—all that she could bear pleasantly, placing the positive pole at the os uteri, and the negative on the spine between the shoulders, and sometimes on the abdomen.

The first attack after treatment came as usual; the second was eight days delayed, the loss not as great. After that time the intervals were longer until menstrual period was regular and normal.

USE OF ELECTRICITY IN DISEASES OF ADOLESCENCE.

BY M. BONNER FLINN, M. D.

During the period of puberty and adolesence many important changes are taking place in the child, frequently causing disturbances of the nervous system. Careful regulation of the physical and mental exertions is necessary.

The average age of entrance to the high schools comes at this critical period. Many pupils are obliged to leave, after one or two years' attendance, because the close confinement and undue tension of the nervous system in study have been greater than their physical condition could contend against.

Overstrain at this time may mean mental and physical wreck. Between the ages of twelve and twenty years the parent should be on the alert, if the child complains much of headache, lumbar pains, tenderness of the spine, general muscular pains, brain weariness, general debility, etc. These symptoms may be the precursors of more serious troubles. Sometimes a placebo may be all that will be necessary; at others, the case will demand more extended treatment. The diagnosis of the physician will better determine the extent of the trouble.

We have to contend during this period with neurasthenia, neurasthenic asthenopia, chorea, epilepsy, aphonia, menstrual irregularities, chlorosis, such nervous deviations as sometimes result in hysteria, and sometimes in temporary insanity.

As there are certain diseases peculiar to physical development, so there are faults and moral aberrations which appear at this age. These latter can be overcome by careful training, plenty of exercise in the open air, and careful diet.

In normal conditions, these years of a child's life are the time of the greatest vitality and ability to resist disease, especially chronic disease.

But, by the high pressure of our modern system of education in the great centers, the adolescent age has become one of great anxiety and perplexity, both to the parent and physician.

If the child inherits taints or hereditary disease, they show themselves during this time by inhibiting growth, which will be a warning to the physician, usually preceding the outbreak of the disease by at least six months, according to the best authority. If the family history is not known, it should be at once looked up, and precautions taken to fortify the system against the development of the disease, or, at least, to so modify it that the life of the patient may be prolonged.

I will not enter upon specialized details of the hygiene, dietetic or medical treatment of these diseases, but will proceed to give you my own experience in the use of electricity in this class of disease.

The object of this paper is to lead the members of this society, by practical investigations, to determine whether these conditions can be aborted by using electrical currents or mixed treatments, at intervals, during the first appearance of adolescence.

My success in the past, in the use of electricity with this class of nervous disorders, has encouraged me to believe that this may be done.

In a majority of cases I prefer the use of the faradic current. Through the medium of the electric hand it is easily regulated to the comfort of the patient.

The galvanic current is not safely used without the milliampere meter, as it is more destructive in its nature, and much harm may be done, through its use, both to the patient and to the cause of electro-therapeutics.

I have found the most benefit in the use of the long-wire faradic coil, using primary wire, No. 18, one hundred feet; No. 2 secondary wire, about two thousand feet; interruptions varying from two hundred to several thousands, according to the impulse needed to produce either the tonic or sedation in the case.

Where extreme hyperæsthesia exists, it requires a sedative current.

I frequently begin with slow interruptions, increasing to more rapid interruptions, so as to meet the different requirements of the special case.

The general treatment I pursue is to place the cathode on the fifth lumbar vertebræ, or under both feet, attached to foot-plate or foot-bath; I apply the anode, labile, from the first cervical to the fifth dorsal vertebræ, ten minutes; then I apply the anode current, labile, over the abdominal and ovarian regions. If the patient complains of severe pains in the head, I treat the region indicated, using electric hand; the entire treatment occupying about half an hour.

There are cases which cannot be reached, without prolonged treatment, so as to produce sedation, resulting in the control of many of the violent symptoms. Where muscular fatigue exists in any group of muscles, or in conditions of general muscular fatigue, I use a mild faradic current of sufficient strength to produce tonic action, prolonged treatment, but never long enough to produce exhaustion.

I have found in some cases, when I did not get the full benefit from the faradic current alone, that by combining the primary and faradic currents as one I met with success; and, at times, with the use of the primary coil alone.

Caution must be exercised, as some patients are extremely sensitive, and a mild current will produce good results, without annoyance or discomfort. After two or three treatments the intensity may be increased. In no case should the current be painful.

At other times, the patient would be unable to warn you when the current was too strong. By the use of the hand as an electrode, letting the current pass through one's own body, the physician can better regulate it. For instance, the abdominal regions are not as susceptible to the sensations of the current as some other portions of the body, hence the patient might be able to endure a much stronger current than would be best to produce the desired results.

As we have no reliable faradic meter, I have formed the habit of using my hand as an electrode, thus regulating the dosage. I find this, especially, a safeguard in all nervous diseases.

This cannot be done in using the galvanic current, which must be measured by the milliampere meter.

In using the hand electrode over the abdomen and internal organs, the physician is able to judge of the amount of action and reaction which is taking place, by the amount of moisture which gathers under the hand, and which, in case of acute inflammation, will be usually of an acid character. In conditions of debility or sub-acute inflammation it will be alkaline.

When there is only vasomotor disturbances (of a neurasthenic type) but little exudation is to be looked for.

The frequency of the treatments varies according to the response I get from the case in hand. Some require daily treatment, and for others once a week will be often enough, or even at longer intervals.

Neurasthenic Asthenopia.—In treating this disease I use electric hand, anode current, over the eyes, five minutes to each eye. Cathode at first cervical vertebræ, or second dorsal, stabile ; current pleasant to the patient, treatment alternate days, or as the case may demand.

In tenderness or irritation of the spine, I place cathode (moist electrode) on coccyx ; pass anode, labile, sponge electrode or electric hand from first dorsal to fifth lumbar vertebræ, about three inches to the right and left of the vertebral column ; primary or secondary current.

Insanity of Puberty and Adolescence.—Hospital records show that over sixteen per cent. of their patients are admitted between the ages of fifteen and twenty.

I will not attempt to give a clinical *résumé*, as its manifestations are not confined to any special group of symptoms and as you are all, to a certain extent, acquainted with its clinical history.

The question is, How can we apply the current to help us in meeting these conditions?

During the past twenty-five years I have been called upon to treat a number of cases which had been under other treatment without permanent benefit. Knowing the good results from the use of electricity in other forms of nervous diseases, I decided to try it with this class, as their clinical histories are so nearly alike, many times.

I will cite a few cases, with my mode of procedure.

Case I. Miss M. B. S. Age twenty-two years; brunette; well developed: family history good. Entered high school during her fifteenth year. At the end of the first year she showed marked restlessness and choreic disturbances. During the second year there was muscular fatigue, loss of appetite, slight attacks of aberration: she gave up the study of instrumental music during this year. Third year, mental fatigue and aberration increased so much as to necessitate her removal from school; her mind became much impaired, with attacks of insanity; appetite capricious; menses normal; bowels regular; neurasthenia quite pronounced.

During this time she had been under medical treatment with different physicians. As she had shown no marked improvement, physicians in consultation advised excision of the clitoris, which was performed by her family physician. (No signs of masturbation.) Results *nil.*

Two years ago I was called to attend her case, with the request that I should try electricity, her friends having heard of my success with some other cases.

I gave but little encouragement, upon my first examination of the case.

At my first treatment, I applied cathode, stabile, to lower lumbar vertebræ; anode to forehead and vertex, stabile, using my hand as electrode, five minutes, then to first dorsal, five minutes. Then a general treatment over the abdomen, current moderate, twenty minutes.

This was carried out for one week, daily; with slight improve-in general symptoms.

Second week, cathode, stabile, twelfth dorsal vertebræ; anode as before. Every third séance, I gave foot-bath, cathode in water, anode, labile, from first cervical to fifth dorsal, ten minutes; then current through bowels, in all half an hour.

At the end of the first month an improvement of mental faculties began to be observable.

I followed up these general and local treatments for three months, three times weekly, meeting with discouragement at times; but finally could see decided gain in muscular and mental vigor.

Previous to electrical treatment she showed no interest and took no part in household affairs, and would not associate with the other members of the family.

From this time on there was a gradual return of interest in things about her; she would assist, when asked, to do things about the home. Her appetite was good and she began at this time to come to my office for treatment, and she would give full account of what transpired between her calls, which occurred twice a week.

At the end of nine months she resumed practice on the piano, and began to sing, for the first in two years. She now takes part in all household duties; her mind is clear, and she is cheerful. She is able to receive and return social calls and was discharged as cured.

She has received no treatment during the past year.

CASE II. Miss J. F. Age nineteen; family history neurotic; menstruated at thirteen; during first two years, period occurred from three to six months apart; after that regular. During these two years there were choreic movements, headaches, appetite capricious; any excitement or overstudy at school would bring on headaches, followed by slight attacks of epilepsy, and during the day or two following would have muscular twitchings. She was taken out of school part of the time during her fourteenth year, and the attacks were not so frequent. In her fifteenth year she returned to school, but the application to her studies and the excitement attendant upon school life brought on complete nervous prostration; choreic action was increased; epileptic seizures two or three times each month, increasing in force, causing impairment of the memory.

I began to use electricity in the case at this time. Cathode at fifth lumbar; anode, labile, over the entire abdomen, fifteen minutes; anode to each foot separately, about five minutes; applied electric hand to forehead, five minutes; treatment once a week. At the end of two months, no improvement.

I changed the mode of treatment during the third month; before menstrual period, gave foot-bath, cathode to the feet; anode at first dorsal, five minutes, stabile; then over abdomen and ovarian region, twenty minutes; current not so as to produce muscular contractions or cause painful sensations. This with the former treatment, at the end of six months, caused the abatement of all choreic symptoms; nervous system improved; epileptic seizures very light, menstrual periods regular.

During the next year the treatments were given at irregular intervals and lasted but fifteen minutes.

At this date, September, 1897, nervous conditions are entirely gone; brain is clear, memory good; no epileptic seizures for two years; weight 125 pounds, in full enjoyment of good health.

During the past two years she has been able to participate in all social pleasures.

Case III. Miss F. P. Age seventeen; slight built; nervous mental temperament; light complexioned; lungs and heart normal; nervous insufficiency of kidneys; bowels costive; appetite capricious; complained of general debility and muscular pains on exertion; neurasthenic asthenopia. Her former physician kept her out of school one year.

February, 1894, she came under my care for electrical treatment. I found that the urine contained slight traces of albumin; red blood corpuscles deficient; anæmic. She was possessed with an inordinate desire for study; memory was fair. Her menses were irregular during school term, but regular at all other times. She complained of severe lumbar pains on walking or riding. I began treating by using cathode, labile, across stomach and abdomen; anode at third dorsal, ten minutes, once in two weeks, strength of current pleasant to the patient. Then placing cathode, stabile, at twelfth dorsal, used anode, labile, over stomach and abdomen, slow vibrations, fifteen minutes.

Cathode, first cervical vertebræ; anode applied to each eye, three minutes. This treatment weekly, for two months, then every two weeks. After that, I combined the two treatments once a month, and continued to do so for four months.

The improvement consequent upon these treatments has enabled her to continue her studies; she has gained in weight, kidneys have become normal, appetite good.

She has not required treatment during the past nine months.

I used, mostly, a mixed current in this case.

THE ELECTRO-PATHOLOGY OF INFLAMMATION.

BY J. H. WOODWARD, M. D.

I have paid considerable attention to the study of the pathology of inflammation, both analytically and synthetically. My purpose was the better understanding of the dynamic force of medicinal agents to abort or modify the local and constitutional effects of the elements of inflammation, while passing through their various stages on the descending scale of disease, from a higher potential at the line of health to a lower potential at zero in morbid anatomy. The chemico-electrical relation of these processes one to the other is a series until necrosis of the tissues is reached at the negative pole. The foregoing changes constitute the sum of our knowlege of the science of inflammation, which is the curative keynote upon which physicians should play to bring these processes at work in the series, according to the law of natural and experimental therapeutics.

In my investigations I have sought to determine the philosophy of the elements that constitute the basic lesion of inflammation, so as to have a premise from which to reason, as to the annex elements which are essential to establish the secondary or constitutional symptoms as the outgrowth of the primary inflammation. Inflammation of a vital organ, when it passes through its various stages from a higher to a lower potential on the descending scale of disease, is divided into two forms, namely: 1st. Primary, 2d. Septic or constitutional. The elements which constitute the primary inflammation are congestion and inflammation of the capillary meshwork of the connective tissue. The annex elements of the septic or constitutional form of inflammation are exudation, strangulation, and suppuration. The elements of both forms when the disease is fully developed are correlated as electro-positive and electro-negative in a series which induce chemico-electric changes similar to the electrolytic effects of galvanism. Congestion and inflammation constitute the primary chemico-electrolytic elements of inflammation. This may be dispersed by a counter force without either of the annex elements being generated and the inflammation passes off by resolution. The elements of exudation, strangulation, and suppuration are polarized as positive and negative in the series underlying the septic or constitutional form of inflammation. They are arranged in the following electrical order: 1. Congestion is the nearest element to the line of health which is electro-positive end of the series. This element precedes inflammation. Hence it extends from a higher to a lower potential on the descending scale of disease, and is electro-positive to inflammation in the series. 2. Inflammation precedes exudation. Hence it moves from a higher to a lower potential on the descending scale of the disease and connected as an electro-positive to exudation in the series. 3. Exudation precedes strangulation. Therefore it extends from a higher to a lower potential on the descending scale of disease and coupled as an electro-positive to strangulation in the series. 4. Strangulation follows exudation. Hence it extends from a higher to a lower potential on the descending scale of disease and coupled as an electro-positive to suppuration in the series. 5. Suppuration is the last element in the series of the morbid processes, at zero on the descending scale of disease, which constitutes it the negative pole of the series of elements in couple.

This completes the series of elements, arranged in alternation as electro-positive and electro-negative in battery form of low tension and large volume of chemico-electrolytic, in causing the elements of inflammation to pass through their various stages from the positive pole at the line of health to the negative pole at zero in pathological anatomy. The chemico-electric current is generated and set free by the alkali in the blood and the acid existing in the juice of the flesh. They are in opposite electrical states and increased in volume, separated by the thin walls of the blood vessels to prevent their neutralization. Thus arranged, they become electrolytic elements which cause the tissues to pass through their stages of disintegration until necrosis is reached.

When the annex elements of exudation, strangulation, and suppuration are added to the series by the chemico-electrical dual actions of the positive alkali and the negative acids in couple, the septic or constitutional form of inflammation is induced. The tissues disintegrate, cells pass through a metabolic state on the descending scale of disease, and suitable soil is prepared for the nidii in which the microscopic organisms germinate and multiply. The septic matter and poisonous gases evolved from the necrosed tissues teem with bacteria that enter first the venous circulation in the centripetal, or ingoing area of the body by endosmosis, from thence through the connective tissue into the arterial circulation of the centrifugal, or outgoing area of the body by exosmosis. This invasion of the two dissimilar halves of the circulation by the bacteria and septic gases induce strangulation of the hemoglobin of the blood by arresting the absorption of oxygen, which renders the circulation feeble, irregular, and sluggish as it moves through the capillaries. As a result of this declension of the *vis vitæ* of the blood, the bacteria and septic gases become more diffused through the solids and fluids of the body, which arrest the supply of protoplasm and oxygen to the tissues, so essential in furnishing the elements of vitality to them. This brings the patient into an electro-negative state to his environments. More is cast off from his body from within than he receives into it from without. Thus the law of transformation of forces that interchangeably exists in matter consumes the higher living organisms by the lower forms of microscopic life. The tissues of the higher are changed into substances destructive to their physical life, which go to supply food for the formative forces of the lower living microscopic organisms, and from the lower to the higher *ad infinitum* in the realm of nature.

Treatment.—It is essential that the physician should know that the centripetal or ingoing, and the centrifugal or outgoing areas of the body contain the basic forces of nutrition, innervation, circulation, and regulate the depurating organs by eliminating poisonous and waste matter through them from the body. It is seen that the functions of these forces so essential to life equal the sum of the vital force in resistance and curative power. The indication of cure in the primary inflammation is to remove the elements of congestion and inflammation, and cause the disease to pass off by resolution, before the annex elements are added to the series by the disease pursuing its regular course. This can only be done when inflammation of the internal organ exists by the use of dynamic therapeutical agencies, those that have a negative contracting effect on the dilated cells of the nerves and tissues of the centripetal or ingoing area of the body, and those that have a positive relaxing effect on the cells of the constricted nerves and blood vessels at the periphery of the centrifugal or outgoing area of the body. This closes the circuit of the therapeutic dynamics of the primary inflammation of an internal organ of the body. The most potent therapeutic invention with which I am familiar to fill these indications by dispersing the elements of the inflammation in its primary stage and to cause it to pass off by resolution is the "electric inductive cabinet." This is so constructed that it relaxes the constricted circular fibers of the capillary vessels and orifices of the ingoing area of the body. This opens its channels and orifices, equalizes the circulation by contracting the dilated blood vessels of the inflamed organ in the ingoing area and dilating those contracted in the outgoing area of the body. This dual action of the dissimilar poles of the cabinet brings about an equilibrium between the forces of the two areas of the body, which stimulates the organs of secretion and excretion. The circulation is equalized, the skin and kidneys are increased in function. The nervous system is calmed and the body is depurated of its septic matter, and by the law of electric atomic attraction and repulsion, the septic matter and poisonous gases thrown off from the system are largely attracted by and deposited on the electro-negative metal lining of the cabinet. Simultaneously the electro-negative atoms of the septic matter and gases remain on the electro-positive skin of the patient, which can be easily removed by sponge bath.

One of the most effective local devices which I use to assist the cabinet and other means of removing the elements of the primary inflammation of internal organs is the vital equalizer, the receiver of which is placed to the region of the inflammation after the surface has been wet with chloroform water. The principle that governs its action belongs to pneumatics. It is known that the air pervades every cell and interspace in the body, and it presses through the outgoing area with the same measure of force as the air outside the body presses inwardly through the ingoing area, thus holding all parts of the body in a state of equilibrium. The centripetal or ingoing air pressure having been removed from the inflamed organs by the equalizer, a vacuum is formed in its receiver which is filled by the outgoing air pressure and tissue to its greatest turgescent capacity at the periphery of the body. The blood in the congested organ enters the general circulation and an anæmia of the organ with its function restored is the normal state.

As coefficient with the means referred to in the treatment of the inflammation I principally rely upon "Shüssler's Tissue Salts," which have a specific and direct action, supplying deficiencies where they exist in morbid processes. They are pleasant to take and are reliable in dynamo-therapeutic power. In this paper it has been my aim to deal with principles in pathology rather than those in therapeutics, knowing that if these are understood by the physician the treatment will be suggested to him. But I am aware that this is an unexplored field of medical thought, and some of the principles herein brought out are new and may not be in full accord with the theories advanced by some of the teachers and authors, but believing that they will stand the test of the crucible of investigation as far as discovery has been made, I submit them to the judgment of the rank and file of my medical co-workers, who with myself are seeking after facts in medical science and wish to be benefited by discovery.

PRACTICAL APPLICATION OF ELECTRO-THERAPEUTICS.

BY CORA BELLE BREWSTER, M. D.

Much has been accomplished in this field, but much remains to be done to make it a perfect science. Electricity has been used in the cure of diseases for over 150 years, and even in the earliest years many achievements were attained. The early reported cures were all attained with Franklin electricity, and this form of electricity can be used with much success in many cases where it is not now much used, especially in nervous mental diseases.

Improvements in the construction of static machines have modified and tempered the irritating qualities of the current to such an extent that, after one application, an expression of satisfaction from the patient is the almost universal reward of the operator.

Its pleasant soothing effect, the stimulation of the circulation, affecting nutrition, as well as the favorable psychic effect are more readily obtained in many cases by the static current than by any other therapeutic measure. In many cases beneficial effects are obtained immediately.

In melancholia, neurasthenia, and kindred neuroses, in which the nutrition of the nerve cell is primarily at fault, a toxic condition is established through the inability of the cells to rid themselves of the results of physiologic activity. This toxic condition is responsible for many of the mental and physical manifestations and the discomfort to which these patients are subject. The aim in treatment is to prevent undue waste of nervous energy and to aid in the elimination of self-produced toxic substances. To this end the highest degree of nutrition possible should be established and maintained, and the agent of greatest value to accomplish this is the static current. Deficient nutrition and deficient elimination aside from heredity are the two factors which enter with greatest frequency into the ætiology of all neuroses. A high degree of nutrition and cell activity in any organ is indicated by an increased circulation of the blood in that organ. In all cases when nutrition of the tissues, especially of the nerve structures, is below par, from any but an organic cause, is the time to test the ability of high potential currents to accelerate the circulation and improve nutrition. Aside from the relief of symptoms to which it is especially directed, there will also be observed improvement in remote visceral disturbances, as indigestion, vertigo, and habitual constipation. It is necessary to use the poles of the battery in an understanding way, as experience has proven that the positive static insulation is invariably an agreeable sensation, and as a rule brings quiet and comfort, the reverse being true of the negative.

The observations of Darnian of Paris upon the temperature, pulse, and urine to determine what, if any, difference there was in the different insulations, resulted in finding that with the positive insulation there was a regulation of the temperature and heart's action, and an increase of urea and diminution of uric acid; while with the negative insulation these changes were less marked in regard to pulse and temperature, and that the volume of urine was increased but no change occurred in the organic constituents. Many physicians who understand the care which must be used in selecting the pole in galvanic electricity pay no attention whatever to the subject in using static electricity because the results are not so immediately discernible, although the difference is just as radical.

In the galvanic current the action of the positive pole is sedative or anodyne, contractive, drying, and hardening to the tissues, by reason of which it is also hemostatic. The anodyne action is due to the liberation of acids at the anode. The negative pole is stimulating, congestive, liquefying, and absorptive. These effects are in part explained by the fact that the alkalies and fluids are precipitated at the negative pole, since both fluids and alkalies have a softening effect on the tissues.

Electricity as a stimulant, sedative, and tonic has no superior, when properly applied. With its aid we can get the effect of medicine without disturbing the stomach. It is well known that whenever a severe physical exercise is indulged in it will produce nervous exhaustion, soreness in the muscles. This is also true of electricity, and we must consider the susceptibility of our patients to electrical excitation. The electrolytic action produces a decomposition of a part of the mass acted upon, thus allowing space for the blood to flow in and bring nutriment to repair the destroyed tissue. The oxygen is absorbed by the hemoglobin, and the acids will destroy any germ life that may be present. But we must not forget the pathological condition presented to us: for, if our current is too strong, or too long a treatment be given, we may produce a worse condition than existed before the application of the current. This is due to the decomposition of the conductive properties of the substance through which the current passes or the failure of nature to refill the capilliaries as fast as electrolytic action occurs. The tissue becomes dryer, causing the electrode to adhere firmly, when an internal electrode is used, and when applied externally electric sores are produced. The acids of the body assist in this destruction and harm is thereby done, instead of beneficial results being attained.

In treating the various ailments with electricity a much discussed subject occurs: Shall we treat our patient symptomatically, or the seat of ailment? Both methods of treatment should be resorted to, and in some cases I find them necessary, for in both conditions there is need of improved nutrition. As an illustration: In hemiplegia we have a lesion which is in the brain; the muscles in the arm or leg on the opposite side to the lesion are affected; they become atrophied and their nerves come to be in an anæsthetic condition. Now, if we should treat the brain alone, which would be unscientific, very little beneficial results would be achieved for the troubled limb, and even if the lesion be repaired, the symptoms would remain. Again, in strictures of the urethra we localize the current to the urethra, the seat of trouble. So let us not say we have only one method of treatment, for both are essential for the cure of diseased conditions.

ESSAY ON THE SYNTHETIC ELECTRO-THERAPEUTICS OF FRANKLINISM AND THE CURRENTS O HIGH FREQUENCY.

BY DR. G. APOSTOLI.

The empiricism, which up to the present has been almost the only guide of the physician applying the static, or the high frequencies, therapeutically, ought to tend to disappear before the profound clinical investigations aided by the physical study of the localization of each of these two electric methods.

The clinic shows constantly fundamental differences in the receptivity and tolerance of patients as well as in the symptomatic reactions determined by this or that electric method.

The clinic further shows that these differences, varying in the same subject, are still more marked with different diseases, following a general diathesis, particularly the preponderance of troubles of nervous origin.

All of these differences cannot be fortuitous, and their origins are readily determined, as well as the diagnostic and therapeutic results.

There are three points to this brief sketch:

First. To collect a general table of the differences of reaction in various patients and various diseases as determined by the different electric procedures.

Second. To give the physical and physiological reasons which permit this different grouping.

Finally, to note the therapeutic consequences which are derived from these premises, establishing a more scientific base for the indications and contra-indications for the static and high frequencies (condenser and auto-conduction with and without contact), thus adding an important contribution to the semeiology of nervous diseases, and opening a new chapter on electro-diagnosis.

A. THE IMMEDIATE AND REMOTE CLINICAL REACTIONS (DURING AND AFTER TREATMENTS BY FRANKLINIZATION AND HIGH FREQUENCIES.)

The symptomatic reactions which follow the application of the above electric methods can be studied from many different points of view, thus the moment of their appearance, their localization, their intensity and duration can be examined.

In the physiological condition, the reactions are generally absent, or slight; a normal subject does not show any sensible reaction, any abnormal sign; he feels neither malaise nor pain, during or immediately after the treatment. At most there is a sensation of cold, or of slight fatigue, with a tendency to somnolence when the treatment is too prolonged.

But with the pathological condition commences a whole scale of symptomatic reactions, which we will examine briefly to-day, and which vary according to the method by which the electricity is applied.

1. *Static.*—One prominent fact dominates the entire application of the static bath, and manifests itself in the first treatment, without any suggestion having called it forth. This is the different response which patients make to the spark and to the static breeze, according to the state of their peripheral nervous system, by which they show more or less definitely hysterical conditions, of which the

most important are abolition of the pharyngeal reflex, perversion of the cutaneous sensibility, etc., etc.

Two different classes of reactions are noticed among these cases:

(*a*) First, the diminution of the cutaneous sensibility to the shock of the sparks, which varies from a slight alternation to the more or less complete absence of sensibility.

It may be stated that the patient is seated on the insulated platform, and sparks are drawn from the back of the hands and from the forehead.

In order to exclude the influence of suggestion, this examination is conducted rapidly and in silence, without telling the patient its object.

From the reaction of the static spark, a classification can be made immediately. In the physiological state the static spark is always more or less painful.

The diminution of sensibility, which may reach complete analgesia, reveals immediately a hysterical condition, with a perversion of the peripheral nervous system predominating.

(*b*) The static breeze, on the contrary, applied to the forehead and head immediately after the trial of the shock of the spark, causes a second reaction which usually confirms the result already determined by the spark.

For, absolutely indifferent in a physiological condition, the breeze frequently is quite acceptable to the hysterical cases—those who are insensible to the shock or the pain of the spark finding it particularly agreeable. Occasionally some hysterical cases, on the contrary, experience a characteristic ennervation and consider this same breeze unpleasant.

I have noticed another interesting fact which can be used diagnostically or prognostically in certain cases difficult to understand.

With some of the hysterical cases which, in the first treatment, bore the sparks without feeling pain, after a few similar treatments there is a noticeable modification in the sensibility.

They seem to awaken progressively and in proportion to the amelioration, and thus bear testimony to the beneficial influence of this treatment in combating certain disturbances of the general cutaneous sensibility. Thus the progression to the normal reaction under the influence of the static can be observed.

Conversely, if the hysterical condition is aggravated, or the patient loses the benefit acquired, this is shown by the return of the anæsthesia to the shock of the spark.

This, then, is a new element which we can use diagnostically and prognostically, and which allows us to appreciate the progress made by a patient under the influence of the electric treatment.

2. *High frequencies.*—To-day we will consider two of the principal methods of application: auto-conduction by the cage; and the condenser (bed?).

Here, as in the static, in the normal condition there is usually no abnormal reaction, sensible or painful. The patient in the cage feels nothing; absolutely nothing, and the incandescent lamp in the cage, which is lit by induction, is the only proof for the patient of the passage of the current.

With the condenser, the patient feels only a slight vibration in the palms of the hands at the point of contact of the body with the current; this sensation is always well tolerated and should never cause pain.

Such is the clinical aspect of the physiological state, but it differs from what is constantly seen with the same patients which we have just seen are particularly affected by the franklinization.

These sometimes show a reaction to the high frequencies during the treatment or immediately after it.

Frequently it is vertigo, often it is headache with the impossibility of reading. Sometimes it is nausea; in a word, all the congestive and cephalic disturbances which in some patients cause an immediate and rapid malaise with an impression of drunkenness.

This reaction, which often manifests itself in the beginning of the séance, does more immediately after, in the hours which follow, appearing as lassitude or extreme fatigue and sometimes reawakens the old pains which appeared to be cured.

We can sum up the reactions we have observed in the methods we have particularly tried (cage without contact—cage with contact—condenser) in the two following formulæ:

The intolerance for the high frequencies, when it exists, diminishes progressively from the state where it occurs in the cage without contact—pure auto-conduction—which is its maximum, through the stage when it is seen in the cage with contact, to the stage where it is not provoked by the condenser.

A second synthetic fact is that there are some hysterical cases—that is, the same patients who not only support the static more or less well, but proclaim it as the treatment of their choice—who present to a varying degree the intolerance to high frequencies I have just considered.

Beside the first group—which includes the neurotics and most (but not all) of the hysterical cases, and which supports the condenser better than the cage in either of its forms—should be placed a second group, debilitated conditions—which includes senile rheumatism, certain neurasthenias, some diabetes, anæmia, and chlorosis.

With these patients, the reaction at the end of a treatment may vary from simple lassitude to complete exhaustion, and it is noticed that the condenser is more tiring than the cage.

B. PHYSICAL AND PHYSIOLOGICAL PATHOGENESIS.

If we investigate the source of these reactions, we find both physical and pathological influences to be considered.

First. From the standpoint of physics. The different topographical distribution of the two electric methods is striking.

Thus in franklinism the current is limited almost entirely to the skin.

With the high frequencies the distribution varies with the method:

(*a*) The pure auto-conduction with the solenoid determines considerable central action (with a small peripheral charge.)

(*b*) The solenoid, with supplementary polar contact, causes the same central action with a greater charge.

(*c*) The maximum charge with the condenser.

Second. From the pathological standpoint the hysterical taint of the patient, with the variable nervous disorders, should explain our classification.

There is, in fact, a true peripheral localization, which acts reflexly on the cord and brain.

Armed with these two physical and physiological facts, it is easy to understand the different reactions with franklinism and the high frequencies, according to the presence or absence of more or less peripheral nervous disturbances, which are usually due to hysteria.

C. DIAGNOSTIC AND THERAPEUTIC VALUE.

These premises have the following consequence:

Diagnosis should be benefited to an extent we cannot yet measure.

Is a certain patient neurotic or hysterical?

Is it a simple neurasthenia or hysteria?

Or is it both at a time?

Franklinism, corroborated by the evidence of the high frequencies, usually clears this point, and also points out the best therapy.

The treatment should be that which gives the best indication in the preceding diagnostic trial.

To some hysterical cases we apply only the static.

In some debilitated conditions we use only the cage, with some diebetics only the condenser.

With certain other patients, we associate the franklinism and the high frequencies.

Such are the outlines of the problem of the diagnostic and therapeutic value of the two methods.

Conclusion.—To recapitulate, the study, though incomplete, of franklinization and the high frequencies, has shown me:

First. That neither is nor should pretend to be supreme or absolute, as each has its own sphere.

Second. That the symptomatic reactions should be useful in electro-diagnosis and assist in determining the therapeutic indications.

A GRAVE CASE OF DERMATITIS FOLLOWING TWO X-RAY APPLICATIONS. PATHOGENESIS AND TREATMENT *

NOTE BY DR. G. APOSTOLI, PRESENTED BY M. D'ARSONVAL.

Professor d'Arsonval, representing Dr. Apostoli, presented to the society for consideration the most severe and rebellious case of dermatitis he had ever known. He gave the history of the case and the new method of treatment he had designed.

The burn had caused a large ulcer on the abdominal wall, which, last February, measured 17.7 cm. by 13.6 cm., and was due to two X-ray applications made at Dublin on May 22 and 28, 1896. In the first of these, lasting forty minutes, the Crooke's tube was 15 cm. from the skin; in the second, lasting ninety minutes, it was only 9 cm. distant.

Immediate Results.—Some nausea followed each séance, but no vomiting.

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* Paris Academy of Sciences, Séance of June 14, 1897 (free translation).

Later Results.—Two days after the latter application, a progressive erythema appeared, which became worse.

Vesicles and blebs followed, secreting considerable serum.

A scar formed gradually.

Notable amelioration in July.

Relapse, with renewed mortification, in August, with burning and intense pain at the level of the gangrenous surface.

Successive use of all known lotions, topical dressings, and caustics for eight months—even skin grafting being tried—was without avail.

From the end of October, 1896, the local application of oxygen was tried daily for five hours. This was the only treatment which was beneficial; it arrested the growth of the ulcer, but did not make it diminish in size.

Electric treatment was begun on February 9, 1897, with the assistance of Dr. Planet, who has outlined the case, as follows:

Daily static bath; breeze over the sore for the twenty or thirty minutes of the treatment.

At the end of March the application of the high frequency current was added to the static treatment. This current was obtained from a bed (?) condenser.

Since April, 1897, bi-weekly hydro-electric baths with undulating current.

Progressive amelioration was observed from the beginning of the electric treatment; it was marked after the undulating current treatment had been added to that of the static breeze.

The dry and adherent scar detached very slowly, but always progressively, and it was but half the size of the original ulcer.

To-day (June) the patient is nearly well, and there is nothing further to be noted.

Dr. Apostoli draws the following conclusions:

1. X-ray applications can, under certain conditions, cause a dermatitis which may appear as a simple erythema, or as an ulcer, which may invade the skin, through to the subjacent cellular tissue.

2. This dermatitis, varying according to location (skin, nail, hairy parts), varies also, to a certain degree, with the general condition of the patient, and resembles, in many respects, an ordinary electric burn, being asystic, apyretic, and healing slowly, and having an equal intensity throughout its extent.

3. This dermatitis results from having the Crooke's tube too near the skin, from a séance of too long duration, or from too many or too frequent applications.

4. Dr. Apostoli suggests as an efficacious treatment the following electric methods, which are regulated in strength and duration by the clinical indications:

(*a*) The static breeze, which by its direct local action, aided by its general influence, hastens the process of repair, and of cicatrization of the ulcer.

(*b*) The polar application of a galvanic current, or, better, of an undulating current, to hasten the throwing off of the scar, and thus to help the topic and trophic action of the static breeze.

(*c*) The general action of a current of high frequency (by the condenser), which, as has been shown by Professor d'Arsonval, raises the coefficient of general nutrition, and adds strength and stability to the economy.

EDITORIAL.

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ELECTRO-THERAPEUTIC MEETINGS.

Once more as the autumn rolls around we are called upon to record the successful meetings of the two societies of electro-therapeutics. While the abundance of material presented at these societies this year has not been equal to some others, there has not been any loss in the quality so far as their practical scope is concerned. This JOURNAL will continue to publish all those papers of merit which were read before the National Society, together with the discussions, and whatever is new in the papers of the American Society will find space in its columns during the next year.

CHANGE IN THE JOURNAL.

Some ten years ago, when the present editor took the editorship of this JOURNAL, it was a very small monthly composed of only ten pages per issue. This gradually increased until it reached the size of about twenty-two pages per issue. Even this size was not found sufficient to contain many of the leading articles with other material, such as the book reviews, epitomes, and translations, without cutting the articles in two. It was, therefore, thought desirable for the time being, to make the JOURNAL a very much larger one and issue it quarterly, but so successful has it been that the publisher now feels justified in returning to a monthly issue, with an increase in size sufficient to accommodate all the matter that may be presented for publication. Therefore, from January 1 the JOURNAL OF ELECTRO-THERAPEUTICS will again become a monthly. Some changes in the policy of the JOURNAL, together with the editorial staff, will be announced at that time.

THE "X-RAY JOURNAL."

In this issue we give in full an article on X-ray injuries taken from the *X-Ray Journal.* This is a new publication which has recently come to our table, and which we welcome most heartily.

The article which we copy is of such a nature that it cannot be epitomized without decided injury to it, and, as it contains so much information on this now prominent and perplexing question, we have given it in full.

The *X-Ray Journal* has our very best wishes, and if it continues to serve the quality of mental pabulum which it has so far, it will certainly find a place on many physicians' tables.

Its editor is Dr. Heber Robarts of St. Louis, Mo., at which place the *Journal* is published.

BOOK REVIEWS.

WARNER'S POCKET MEDICAL DICTIONARY OF TO-DAY, comprising pronunciation and definition of 10,000 essential words and terms used in medicine and associated sciences. By WILLIAM R. WARNER. William R. Warner & Co., Philadelphia, 1897.

The scope of this little book is very well given on the title page as quoted above. It is especially designed as a pocket companion and is strongly bound for that purpose. Particular attention has been given to pronunciation and to the condensation of the definitions. Many of the common medical words have been omitted to give place to others without enlarging the book beyond what it is claimed to be—a pocket guide. Diphthongs have been omitted, with a few exceptions, and obsolete medical terms have been entirely left out. The book is especially valuable to the medical student.

URINALYSIS; A GUIDE FOR THE BUSY PRACTITIONER. By HEINRICH STERN, Ph. D., M. D. E. R. Pelton, 129 Fifth Avenue, New York, 1897.

This small book is, as the author claims, a thoroughly practical and concise guide in urinalysis. The book contains sixty pages with printing only on one side of the leaf, leaving a blank page for notes opposite each printed page. It is divided into three sections. The first gives the apparatus necessary for the physician's laboratory, and then proceeds to sketch the normal constituents of the urine. The second section treats of the chemical analysis; first the test for the normal constituents, such as urea, and second, for the abnormal constituents. While the author states that it is considered to be a very concise work, it is most complete in detail in these sections. The third section is given up entirely to microscopical examination, which he divides into chemical bodies and anatomical bodies.

EPITOMES.

X-RAY INJURIES.

BY N. STONE SCOTT, A. M., M. D., CLEVELAND, O.

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The question of X-ray injuries is of so much importance that it has excited great interest and has received extensive notice in the medical, electrical, and lay press. As regards the medical press this is especially true of a case reported by a physician, who, without X-ray experience, has relied on his medical knowledge alone, and has advanced an erroneous theory of the first importance.

It has been evident for a year past that the X-rays are sufficiently powerful to produce under some conditions most disastrous results, but very diverse views have been held as to the cause, the frequency, the kind of apparatus most likely to produce them, and the best way to avoid them.

In order to assist in arriving at a proper solution of these questions, I have sent a circular to most of the leading medical and electrical men who are doing X-ray work, asking for particulars of X-ray injuries. The questions asked include the kind of apparatus, length of spark, number of exposures, distance of platinum from the part exposed, and inquiries relating to the characteristics of the injury itself. The results of these investigations are shown on the accompanying chart. Some fifty personal replies have been received; one-quarter of these report forty-five hundred cases, and, since a large number of the leading men in X-ray work are to be found among the writers of the three-quarters giving no estimate of the number of cases examined, it is certainly not an overestimate to say that this report includes at least twenty thousand examinations, exclusive of those made by X-ray exhibitors. This list contains thirty-one cases of injury, or one in about thirteen hundred.

Dr. Gilchrist of the the Johns Hopkins Hospital has collated from the literature twenty-four cases of injury. I have, mainly by personal letters, increased this to sixty-nine. This includes the case of J. Lynn Thomas, of cystitis, which the author thinks was not due to X-rays; one reported by Dr. Wallace, in which she attributes an aggravation of renal colic to the action of X-rays; one reported by Professor Blake, in which there was the formation of abscess, evidently due, as the professor thinks, to an increase of the original difficulty. It includes a similar case of my own, of a felon, which I think an incident rather than a result of the X-ray examination. The chart also shows twenty-three cases listed as X-ray exhibitors, as well as several cases in which the injury was doubtless an increase of the trouble for which the case was examined, rather than an X-ray injury.

Many of the reported injuries occurred in the early days of the discovery, when the apparatus was crude or the operator inexperienced. It is not difficult in most of the severe cases to see how it might have been avoided.

The symptoms of all cases, except the few where deeper structures were supposed to have been affected, present the picture of a dermatitis, the distinctive feature of which is its slow onset and tendency to assume a chronic form. Those who work extensively with X-rays are frequently compelled to give up their work. The first symptoms appear, as a rule, in from three to seven days. Fuchs, however, reports a case of one exposure of an hour, in which the hand had a frozen appearance during the exposure, with pain, redness, and swelling, which commenced at once, continuing to vesication. Professors Daniels, Marcuse, Kolle, J. Mount Bleyer, and others, mention cases which were several weeks in developing symptoms that were noticeable.

The skin directly over that strongest source of X-rays, the platinum terminal, first commences to swell, becoming red and painful; this gradually extends to parts farther from the source of X-rays, even to those parts not directly exposed. The pain is of a deep-seated, dull, aching character (although some cases run their course without pain). Vesicles then appear filled at first with a serous exudate and purulent material; in severe cases a sphacelus forms which is gradually thrown off, leaving a raw granulating surface slow to develop and slow to heal.

The kind of apparatus seems to make no difference; the Ruhmkorff coil, the Tesla coil, and the static machine have all given severe cases. The majority have been given by the Ruhmkorff coil; but this is due simply to the fact that this was the first kind in use, and is yet by far the most frequently used.

Distance of the platinum terminal is of importance, because, when the platinum is near, the X-ray is concentrated upon a small surface; but if the ray is strong enough to produce desired effects, it will be strong enough to produce the undesired if continued too long. Kolle and Richardson both report cases where the platinum was eighteen inches away; Richardson's case being submitted to three examinations (on successive days) of twenty, thirty, and thirty-five minutes, a total of only eighty-five minutes.

The length of time is also important. On the chart five cases are reported from exposures of less than one hour. In cases No. 1 and No. 57 the distance of the terminal is not given; the time is forty-five minutes. No. 21, which is exactly one hour exposure, with quite severe symptoms, had the terminal at only five inches. No. 41, though extremely short in time, only five minutes each on three successive days, was only one inch from the terminal. If the experiment had been made at a distance of eight inches this would have been equivalent to some five hours' exposure; not so very short a time after all. It seems probable that the most susceptible would not be affected by any exposure lasting an hour if the terminal is at least ten inches away; this, under all ordinary circumstances, is amply sufficient for a medical examination.

Consideration of the causes of X-ray injuries would take us too far beyond the scope of this paper, and belongs legitimately to the electricians, who are at wide variance with one another. I shall only mention in passing the various theories. Elihu Thompson advanced the theory that the burns were caused by ultra violet light; he has since proved to his own satisfaction, although not to the satisfaction of some others, the falsity of this hypothesis. Tesla considers the injury due to ozone generated at the point of contact of the X-ray. Another believes it to be nitrous acid. Several experimenters think it is produced by particles bombarded off the terminal. One observer believes the particles floating in the air are bombarded into the skin by the X-ray. A number of operators have advanced the theory that the burns are caused by static or other electrical discharge. It seems certain that if it be not due to the X-rays directly, it must be something which goes where they go, and anything which would protect would stop the ray, since cases of injury have occurred through clothing of various kinds and through many protective substances, such as vaseline, zinc ointment, thin aluminum, etc.

That the X-rays do affect the skin seems certain, but that deeper structures are affected primarily, is at least doubtful. Among the reported cases there are but six which can possibly be so classed.

Dr. A. G. Wallace, in the *Kansas Medical Journal*, February, 1897, reports a case of renal colic, which prior to the X-ray examination had been having attacks about once a month ; after the X-rays were used these occurred every day and a large quantity of sand was passed. This "integration of the calculus" the doctor attributes to the X-ray. There have been many cases of renal calculi examined by X-rays, and, since this case is the only one in which such a result has been noticed, it seems much more probable that this increase was a coincidence rather than a result.

Dr. J. Lynn Thomas, in the *British Medical Journal*, March, 1897, reports a case of stone in the bladder, which, the day following an exposure to the X-rays lasting sixty-five minutes, developed a cystitis. Dr. Thomas does not think the X-ray caused the cystitis; a conclusion which seems eminently proper, in view of the fact that a bladder with a stone in it is sure, sooner or later, to develop cystitis ; yet it may be possible that the irritation of the stone, while not enough to produce symptoms of its own, may have been enough so that the slight added irritation of the X-ray brought on the cystitis. The case is certainly of great interest, and worthy of record.

The *Electrical Journal*, December 1, 1896, contains an account of a case in which Professor Blake examined the ankle by X-rays; six weeks later an abscess opened in the region of the ankle joint. Professor Blake in a personal communication to me says that he thinks the abscess due to the original trouble for which the examination was made.

This leaves three cases in which there is a reasonable doubt as to the existence of a periostitis. One was reported to me by my friend Dr. B. Of this case the doctor says: "The periostitis which resulted from the X-ray examination delayed an operation which was necessary for an old dislocation of the ulna, and the exudate which was thrown out tended to interfere with a better result." That this bad effect was due to the X-ray is at least doubtful. Hundreds of examinations have been made for fractures and dislocations without producing such results. On the other hand, medical history is replete with cases of comparatively trivial fractures and dislocations which later developed periostitis. Thus it certainly is not proven that the X-ray was an ætiological factor in the production of the periostitis.

My own case was that of a quadroon, twenty-eight years old, who had her hand severely crushed and burned five years before in the hot mangle of a laundry. As a result of this there was extensive sloughing of the soft parts, and consequent cicatricial contraction, when the hand finally healed. December 18, 1896, the hand was viewed several times in the fluoroscope, and two skiagraphs were taken. The apparatus consisted of a Tesla coil and double focus tube, made by the Warren Tube Works after my own drawings. The hand was placed eight inches from the platinum terminal, the exposures lasting one and a half minute each. January 14, 1897, almost a month after the examination, she presented herself with an inflammation of the distal phalanx of the middle finger. The pain, she said, started at the time the examination was made, and had been very severe until some days since, when an abscess broke between this finger and the next, to which it was closely bound. From this time on the pain was comparatively slight, lasting for a number of weeks, until, finally, a small sequestrum was discharged, after which it healed rapidly. At no time did I see any inflammation of the skin. There was undoubtedly in this case an ostitis and accompanying periostitis, that this developed soon after an X-ray exposure is equally true, and it is impossible to prove that the inflammation was not due to the X-ray. It has to be borne in mind, however, that these cases of scar tissue and consequent lowered vitality are especially prone to inflammatory reaction ;

and some other accident, possibly slight, which she either unconsciously or willfully overlooked, might easily have been the determining cause.

The case of Dr. Gilchrist I have reserved to the last, because of its importance, of the wide publicity given it, and because of the harm done by the erroneous deduction which the doctor has drawn. In the beginning of the X-ray work, many physicists, because they were in a position to manipulate a Crooke's tube, undertook to pass judgment upon medical subjects. Much wild semi-medical talk and writing was indulged in, and not a little harm done, so that the profession was not slow to see that medical men must equip themselves to retain control of medical subjects. As an illustration I would cite a little book entitled "Something About X-Rays for Everybody," by Edward Trevert, Electrician. On page 61 he says: "Figure 38 shows the bones of a young woman's arm, consisting of the humerus (upper bone), the hinge joint of the elbow, and the ulna and radius (the lower bones). A fracture of the radius near the elbow is distinctly shown." This fracture, which is so distinctly shown, is nothing else than the bicipital tuberosity. Such mistakes were very natural, and arose from a lack of medical experience and knowledge. But a medical knowledge is not the only requisite, and Dr. Gilchrist, who is not an X-ray operator, has made a very natural mistake on the other side, and given a wrong interpretation to his skiagraphs when he infers that there is an osteoplastic periostitis present. The case was, briefly, that of an X-ray exhibitor, who, after exposing his hand four hours daily for three weeks, had a dermatitis develop over the hand, wrist, and forearm. The points on which the doctor relies for a diagnosis of "osteoplastic periostitis, and probably an ostitis," are:

1st. Pain which was of an aching, throbbing character, so that he frequently could not sleep at night.

2d. The phalanges were noticed to be distinctly thickened.

3d. Voluntary movements of both fingers and hand were abolished; he complained of the joints being very stiff.

4th. Photographs show all the phalanges of the right hand much thicker than those of the left, normal hand. The increase in size is particularly marked in the first phalanges of the index and second fingers. It cannot be said from the photographs, alone, that any of the carpal bones were increased in size.

5th. The spaces between the bones at the joints were much less marked and narrower than those of the normal hand.

6th. The outlines of the affected bone were more irregular and rougher.

7th. The bones were denser in appearance.

Let us review his reasons and, if possible, answer them:

1st. Pain of a dull, aching, throbbing character, might suggest bone pain, but it is also characteristic of most X-ray burns, even those on the thigh and abdomen, where it cannot be due to injury of underlying bones.

2d. The sensation of the phalanges being thickened, might be due to a thickening of the bone, but, if the skin is thickened and infiltrated, it would be very easy to imagine that the bones were thickened. A comparison between the diseased and normal finger by the sense of touch would be most deceptive.

3d. The feeling of stiff joints and loss of voluntary movements would certainly be the result in a severe dermatitis with infiltration of the deeper portion of the skin, and, furthermore, if the bones involving the finger joints had been involved and the carpal bones not—as judging from the skiagraphs is the case—the fingers ought to be stiff, the wrist movable. The history distinctly says, however, that the wrist was stiff.

4th. When one views the hand through a fluoroscope, and has the strength of the X-ray gradually increased, the first thing seen will be an outline of the hand, then gradually the bones become clearer, and after a little the thinner parts of the flesh gradually fade out, as it were, and, lastly, even the bones seem to dissolve, commencing at the thinner and smaller ones. So, too, if one takes a skiagraph of the hand, and gives sufficient time to properly bring out the wrist and thicker parts, the thin parts will be overtimed. It was while conducting a series of experiments some time since, to overcome the unequal exposure, that I got some pictures of normal hands which offer an explanation and refutation of the fourth, fifth, sixth, and seventh points made by Dr. Gilchrist. These pictures were made by shading the thinner parts, during part of the exposure, with lead plates. Apparently

X-RAY INJURIES. N. STONE SCOTT, M. D.

No	NAME.	REPORTED BY	WHERE REPORTED.	Age.	APPARATUS USED.	LENGTH OF SPARK.	Distance from Platinum Reflector	EXPOSURES.		DATE. Time of Developm'nt	PART EXPOS'D	DURATION OF SYMPTOMS.	SYMPTOMS	REMOTE RESULTS.	REMARKS.
								No.	Length.						
1	P	Dr. B.	Personal.	28	Ruhmkorff.			1	45 min.	Mar. 15, '97. 3 Weeks.	Left Thigh.	Ulcer, 8"x6" 2 mos. after.	Blebs followed by Dermatitis Ulcer, 6"x8"	Epidermisation.	Progressing Slowly.
2	G. W M	Dr. W E. Parker New Orleans.	New Orleans Med. and Surg. Jour. p. 156, Sep. 96.					5	July 1—30 mi. " 3—40 " " 4—40 " " 6—60 " " 9—80 "	July 4, Swollen and Red. July 7, Swollen and Red. 2½ Weeks.	Left Inferior Maxilla.	2½ Weeks.	Swollen and Red. Peeling of Epidermis.	Hair on Left side of Face no longer grows.	Bullet Subsequently Located.
3	O. Smith.	Mr Green.	Personal.	20	7-in. Coil Experim'nt'l Tube.	6"	8"	3	1 hour each.	Dec. 18, 19, 20, '96. 10 Days.	Head.	3 Months.	Appearance of Scald—Loss of Hair.	Thoroughly Recovered, Hair Returned.	Since using short exposure with Static Machine—No bad results.
4	Elihu Thompson.	Elihu Thompson.	Personal.	43	Static Machine, Single Focus Tube.	4"	1¼"	1	30 min.	9 Days.	Little Finger of Left Hand.	7 Weeks.	Dermatitis and Ulc-ration.	Scar.	
5	Elihu Thompson.	Elihu Thompson.	Personal.	43	Static Machine, Single Focus Tube.		⅝"	1	12 min.	11 Days.	Third Finger of Left Hand.	3 Weeks.	Dermatitis.		No effect thr'gh lead and tin foil. Effect through Al'min'm and on exposed surface
6		Elihu Thompson.	Boston Medical and Surgical Journal Dec. '96.										Severe		Occurred in Edison's Laboratory.
7		Elihu Thompson.											Severe.	Severe Symptoms.	Had to Stop Work.
8	Tube Tester.	Elihu Thompson.												Had to Stop Work.	Owing to arms being affected thr'gh clothing.
9	H	Mr T	Personal.	22							Hands.				Letter implies he worked with X-Ray.
10	Jno. McA W.	Capt. W. B. Banister	Medical Record, Jan. 28, '97	45				8 8	1½ hours ea. Total, 12 hrs.	Aug. 11 and 12, '96 Sept. 9, 10, 11, 12.	Abdom'n	Aug. 11 and 12, Slight Redness Signs on Sept. 9, Gradually increase—Dermatitis and Ulcerat'n —15"x 8"		Lost Hair on Face and Hands—Change color at 6 mos. Ulcer, 8"x8"	
11	Dr. A. D. Rockwell.	Dr. A. D. Rockwell.	Medical Record, Apr 24, '97		Static Machine.			Frequent Short.		March '97. During and immediately following exposure.	Left Hand.	Dermatitis with Exfoliation.		Not entirely well 6 weeks after—Pain deep seated—Hot.	
12	N.	Dr H.	Personal.		Edison 6" Coil.		6"	100 a day for 3 weeks. 3 a day for 2 weeks.		Nov. 28, '96, 2 Weeks.	Left Hand.	5 Weeks.	Dermatitis Pains and Swelling.	Roughness and Slight Lack of Nutrition.	

13	H.	Prof. C.	Personal.		Ruhmkorff Coil.	12"	8"	2	30 min. each.	4 Days..	Breast.	2 Months.	Like burn—more persistent.	No injury.	
14		Prof. C.	Personal.		Ruhmkorff Coil.			1	5 min.		Wrist.	2 Weeks.	Slight burn.		
15	Dr. G. C. Skinner	Dr. G. C. Skinner	Personal.	27	Tesla Coil.	9"	4"	8	20 min. each.	Sep. 20-22, '96 10 Days.	Wrist.	3½ months.	Dermatitis with Ulceration.	Implication from	of Tendons Inflammation.
16		Dr. G. C. Skinner	Personal.		Tesla Coil.						Abdom'n		Dermatitis with Ulceration.		
17	P.	Prof. H.	Personal.		Tesla Coil. Double Focus Tube.	8"	6"	1	20 min.	July 2, '96 2 hrs.	Knee.	Several Weeks.	Spot 2½" steam	Diam. like burn.	Inflamed and painful before exposure.
18		Mr. S.	Personal.					1	20 min.		Thigh.		Burn.		
19		Mr. S.	Personal.					1	30 min.		Thigh.		Burn.		
20	M.	Prof. M.	Personal.	30	Ruhmkorff 10" Focus Tube.	10"	3"-12"		Various short for 4 days.	Sept. 15, '96 Week or more	Left Hand.	2 Weeks.	Dermatitis like Ivy poison.	None.	
21	S.	Dr. B	Personal.	50	Ruhmkorff Coil.	8"	6"	2	30 min. each,	Sept. '96 10 Days.	Arm and Hand.	2-3 Weeks.	Symptoms of Periostitis.	Inflammation for dislo Interferes by better	n delays opera cated Ulna. exudation with results.
22	J.	Mr. J.	Personal.	27	Ruhmkorff Coil, Single Focus Tube.	7"	4"-20"		1—4 hours daily for two weeks.	July, '96.	Hand and Face	5 Weeks.	Like Ivy poison suppuration.	Scar, Loss of Beard, Injury to sight.	Beard grows in more scanty and of different color.
23	H.	Dr. K.	Personal.		Ruhmkorff Coil.		6"	3	1½ hrs. each.	Dec. 12, '96 3 Weeks.	Abdom'n	Several Weeks.	Dermatitis and Ulceration		Cloth over skin.
24	G.	Dr. K.	Personal.				6"	3	1½ hrs. each.	Jan. 31, '97 4 Weeks.	Left Hip.		Dermatitis and Ulceration.		Used vaseline freely at each exposure.
25		Dr. J. C. White.	Boston Med. and Surg Journal. Dec. '96.					2	30 min. 45 min. following day.	July, '96 Day after 2d exposure.	Sternum.	Nov. 15, two spots unhealed.	Dermatitis and Ulceration.		
26	G. S. Newcomb.	G S. Newcomb.	Mod. Med Science, Nov. '96								Hand.		Dermatitis and Ulceration		Had to renounce further investigation.
27		Dr. W. V. Gage.	Medical Record								Body.		Dermatitis and Ulceration.		
28		H. C. Drury.	Brit. Med. Nov. 7, '96.	35				2	1 hour. 1½ hr. 6 days later.	Nausea after each exposure. Derm. 2d, after 2d exposure.	Abdom'n		Nausea, Dermatitis and Ulceration, 7½"x8¼"		Symptoms of Renal Calculus.
29	Prof. Reid.	G. E. Armstrong.	Montreal Med. Jour. Apr. '97.		10" Spark Focus Tube		8"	4	20 and 40 mi. 50 " 50 "	Nov. 2. " 3. " 5.	Abdom'n and Chest.	33 Days.	Dermatitis and Ulceration, 30 sq. in.	Hair removed.	Waistcoat lined with scarlet flannel.
30		Dr. E. H. Lee	Jour. Amer. Med. Ass'n, Jan. 16, '97.					3 or 4 a day for a wk.	¾-1 hour.	After three exposures.	Head.		Dermatitis and Ulceration.	Eye closed but has gran of con	during exposure ulated surface junctiva.

31	E. H.	Dr H. R. Crocker	Brit. Med. Journal, Jan 2, '97.	16	Coil and Accumulat'r		6"	1	1 hour.	1 Day. Oct. 13	Epigastrium.	3 Weeks.	Dermatitis and Ulceration.		Lower border sharply defined where trousers were turned down.
32		Prof. Daniel.	New York Med. Record, Apr. 25, '96.				½"	1	1 hour	21 Days.			Bald Spot, no inflam'tn.		
33		Marcuse.	Deutsche Med. Woche, No. 30, '96.	17	Hittorff			1 or 2 a day fr a mo.	5-15 min.	14 Days.	Face.	3 Months.	Dermatitis, Ulceration with Loss of Hair		
34	Dr. A. B. Kibbe.	Dr. A. B. Kibbe.	New York Med. Jour. Jan. 16, '97.		Single Focus Tube.		4"	L H 20, R H 5, Elb 2.	5 min. 7-10 min	2 Days Like Sunbr'n	Face and Elbow.		Dermatitis.		Covered with clothing.
35		Fuchs	Deutsche, Med. Woche, No. 35.			16 cm				During Exposure.	Left Hand.		Vesicles, 15 min. after exposure.		Hand looks as if frozen.
36	R.	Dr. E. E. King.	Canadian Proct., Nov. '96.								Hand.		Derm. with Blebs.		
37	J K.	Dr. F S. Kolle.	Brooklyn Med. Jour. Dec. '96.	12	Induction Coil, Thomp. dbl. Focus Tube.	10"-12"	18"			Oct. 21 19 Days.	Scull	4 Months.	Loss of Hair, No inflam'tn	Complete recovery.	Alopecia Areata.
38	S. J R.	S. J R.	Nature, Oct. 29, '96.		8"				Several hrs. a day.		Hand.		Dermatitis —Blebs.		
39	A. J	Leopold Freund.	Wiener, M. W Mar. 6, '97.	5	Ruhmkorff				10 days 2 hrs. daily.	Nov. 24, '96.	Back.		Dermatitis, not serious.		Removed hair from hypertricosis.
40	L.	Mr L.	Personal.	32	Induction Coil, Greiner	6"-8"	1"-2"	3	5 min. each.	April 4 19 Days.	Chest over Heart, and Hand.	2 Weeks.	Dermatitis, Ulceration Slight.	None	
41		Dr. S.	Personal.		Ruhmkorff.	6"-8"	2"-8"	1	5 hours.		Head	Not well yet.	Ulceration extended to the Bone.		
42		Dr. S.	Personal.					1	10 hours.		Abdom'n		Very severe		
43		Dr. S.	Personal.								Chest.		Superficial.		
44		Dr. S.	Personal.								Chest.		Superficial.		
45		Dr. S.	Personal.								Thigh.		Superficial.		
46		Dr. J. Lynn Thomas.	Brit. Med. Journal, Mar. 27, '97.	60						Next Day.		1 Week.	Cystitis	Stone in bla think cystiti exp	dder. Does not s due to x-ray osure.
47		Dr. A. McK. Wallace.	Kansas Med. Journal, Feb. 13, '97.						1½ hours.	Apr. 14, '96				Severe case attributed re	of Renal Colic to x-ray by porter.
48	Miss C. Liebengood	Prof. Blake.	Electrical Journal, Dec. 1, '96.							Few Days	Foot.		Abscess after abscess.	Tested 6 we disease. Re not due	eks before for porter thinks to x-ray.

49	E. C. A.	Dr. A. Forster.	Deutsche Med. Woche, Feb. '97.	30			10 cm	1	25 min.	Jan. 1 5 Days.	Head.		Dermatitis. Loss of Hair.		
50	C. B. E.	Dr. A. Forster.	Deutsche Med. Woche, Feb. '97.	40				2 3	15 min. each. 40 min. each	Dec. 8, 2 days " 15, 3 "	Head.		Slight Redness, Dermatitis, Loss of Hair.		
51	Prof. Wilson	Caffrey & Wilson.	Electrical World, Jan. 9, '97.					2	3 hrs. each. 2 days.	Sept. '96	Fingers, Left Hand.		Dermatitis and Ulceration.		
52	T.		Personal.	50	Induction Coil, 6" Spark.	10"	3"-4"	2	1 and 2 hrs.	Several days	Abdom'n		Dermatitis and Ulceration.	Still confined to house after 10 months.	
53	O. Leppin.	O. Leppin.	Deutsche Med. Woche, July 9, '96.						Frequently for many days		Left Hand and Fingers.		Dermatitis with vesicles.	After 8 weeks hand still looked older than the other.	
54		Dr. Feilchenfeld	Deutsche Med. Woche, July 23, '96.				Exhibited case similar to Dr. Marcuse's. No details given.								
55	Photographer.	Dr. Conrad.	Codex Medicus, Aug. '96.						Frequently and for some time.		1st & 2d Fingers Left Hand.		Dermatitis—Slight.		
56		Sehrwole.	Deutsche Med. Woche, Oct. 8, '96.					1	95 min.	2 Weeks.	Abdom'n	9 or 10 Weeks	Dermatitis and Ulceration.		
57	J. MacIntyre	J. MacIntyre	Nature, Nov. 19, '96.	35							Hand.		Dermatitis and Exfoliation.		Thinks electricity chief cause.
58		M. S. Stern.	Am. Med. and Surg. Bulletin, Nov. 21, '96.					8	40-50 min. each.	2 Days.	Chest.		Dermatitis, face to umbilicus, and Ulceration.		
59		Dr M. H. Richardson.	Med. News, Dec. 26, '96.				15"	3	20-30-35 min. each.	2 Days.	Abdom'n	4 Months, 4" Ulcer.	Dermatitis and Ulceration, 3".		
60		Univ. of Minn.	Med. Record, Dec. 19, 96.					1	Several hours.		Ear.		Hair lost surrounding Ear.		Frozen appearance.
61	X-Ray Exhibitor.	Dr T.C. Gilchrist	Johns-Hopkins Hosp. Bulletin, Feb. '97.						Frequent.		Hands.		Dermatitis with Exfoliation.		Reporter thinks it case of osteoplastic periostitis.
62		Dr W. Downe.	Lancet, '96. ii 1049.							10 Days.	Neck and Scalp.		Dermatitis, Vesication and Loss of Hair.		
63		Dr. Sewell.	Lancet, '96. ii 1049.		Reported similar case.										
64		Dr. M. Rendy.	New York Med. Jour. Feb. 20, '97.					1	55 min.	Erythema soon after.	Chest.	Several Weeks	Dermatitis and Ulceration.		

65		Dr. B	Personal.	40	Ruhmkorff with break.	10"-16"	10"-20"	1	15-30 min	May '96 14 Days.	Chest.	10 Days.	Burning Pains.		Thinks cause floating particles propelled into skin.
66		Dr. B.	Personal.	31			10"-20"	1	15-30 min.	Nov. '96 7 Days.	Back.	10 Days.	Burning Pains.		
67		Dr B.	Personal.	37			10"-20"	1	15-30 min.	Dec. '96 10 Days.	Back.	10 Days.	Burning Pains.		
68		Dr. O.	Personal.												
69		Dr. N. Stone Scott.		28	Tesla Coil Double Focus Tube.		8'	2	½ min. each	Dec. '96 soon after.	Hand (m'ngld)	Several Weeks.	Felon No-Dermatitis.	Complete recovery.	Probably not due to exposure

the infiltration of the skin and its consequent thickening has brought about the same result that the lead plate produced with a normal hand.

5th. In the under-exposed hand the joints are much less marked and narrower than in the one over-exposed.

6th. The under-exposed is also the cause of the affected bones being more irregular and rougher, because in the over-exposed bone the lesser projections and irregularities are first to disappear, thus diminishing the apparent size and smoothing off the outline.

7th. The same reason accounts for the apparent density of the bones.

8th. Aside from these points, an examination of the outlines of the soft parts shows that those of the affected hand are plainer than those in the other, adding to the proof that the affected hand is relatively under-exposed. And last, but not least, I must criticise any deductions drawn from a comparison between one picture of each hand on the assumption that they are taken under similar circumstances. One cannot be sure that a tube is working just the same during two exposures, and since we have no standard of measure for X-rays, it is impossible to say that the relative exposure is the same. This case of Dr. Gilchrist's should have had a series of pictures taken of each hand.

In conclusion I would recapitulate:

1st. Injuries are very rare when proper precautions are taken.

2d. Injuries are limited to the skin and contiguous structures, at least it is not proven that deeper parts are injuriously affected.

3d. It is probable that the bones or deeper structures are not affected.

4th. The proper precautions consist in confining X-ray examinations to short exposures, not to exceed one hour for a distance of ten inches from the terminal, and not to be repeated until sufficient time has elapsed to show that no bad effects seem likely to develop.

5th. If repeated, short exposures are made, the slightest bad symptoms should be an indication to cease all further exposures.

CATAPHORESIS.

BY H. C. SAMPLE, M. D., CHICAGO, ILL.

Cataphoresis is a term used to indicate electric osmoses. Chemical bodies are classified in this science as either electro-positive or electro-negative. The alkalies are electro-positive and the acids are electro-negative elements.

In the cataphoric process some medicines are carried more rapidly than others. The alkalies more rapidly than the acids, some alkalies more rapidly than others, and some acids more quickly than others.

I will give a few of the many elements that are electro-positive and electro-negative.

Electro-positive solutions: Hydrogen, potassium, sodium, silver, copper, tin, nickel, zinc, lead, magnesium, calcium, ichthyol, ammonium, gelsemium, jaborandi, iodoform, cocaine.

Electro-negative solutions: Oxygen, chlorine, bromine, nitrogen, sulphur, fluorine, phosphorus, carbon, iodine.

This shows that there is a law of polarity that must be observed in cataphoresis, also a chemical law that must not be forgotten, and that is: In cocaine we have the chemical formula of C_{17} H_{21} NO_4 Hc_1; when used upon the positive pole the acid part of the chemical will remain at the anelectrotonic zone, and the base, cocaine, will be driven into the tissues.

Chloroform having the chemical symbols of CH, CL_3 and which may be considered as being the chloride of the tri-valent radical formyl, would theoretically be used upon the positive pole, but some electro-therapeutists claim it is electro-negative. This claim, no doubt, is due to its quick absorbent properties, but it is electro-positive and so is ether.

Lithium solutions generally are electro-positive, but benzoate of lithium is electro-negative. In this case the benzoic acid and lithium are in such close union that if it be placed at the positive pole, will remain in that vicinity with the acid and can only be carried into the tissues at the negative pole.

Iodine also has a strong affinity with the ingredients that are usually united with it, and carries them with it in the cataphoric process.

When we are satisfied that we have a neutral agent and are desirous of its action, it is best applied by putting equal amounts on both poles and in close proximity to each other.

In skin affections such as eczema, erysipelas, or any disease of a parasitic nature, cataphoresis surpasses any other method, using one one-thousandth of bichloride.

In uric acid deposits, piperazin or propylamin, which are electro-positive elements, will give gratifying results.

For a lateral curved spine use ichthyol on the convex side of spine. Anchylosis or gleet, use ichthyol. For pain use gelsemium ; œdema, use jaborandi.

The dosage depends upon the conditions presented, and while we put very little of the drug into the body, not more than about one-third of the amount used during a ten-minute séance, yet it is put where it is needed and very little of it is necessary.

The volume of current used in cataphoresis varies from 10 to 20 milliamperes. After a ten minutes' séance, or if 40 milliamperes be used, the acids of the body accumulate at the anelectrotonic zone to such an extent that the medicine is partially destroyed, and similar effect occurs at the negative pole ; therefore a mild current, and of not more than ten minutes' duration, should be used.—*Medical Brief.*

ELECTRICAL MISCELLANY.

—Dr. Robert Newman has resumed his regular lectures on electro-therapeutics once a week at the Hackensack hospital before the staff of physicians of the hospital and the corps of nurses ; the lectures are supplemented by every day clinics in the wards, as well as the latest in the care and uses of batteries of all kinds.

—The large static machine manufactured by the Waite & Bartlett Manfacturing Co. of New York City, for Dr. F. A. Gardner of Washington, D. C., demands more than a passing notice, and will prove of great interest, not only to the medical profession, but to all scientists. It certainly lays open to view the wonderful powers of static electricity, the possibilities of which have been undeveloped for the want of well-constructed and powerful machines.

Some idea of the immensity of this machine may be obtained when we consider. The case is eleven feet long, nine feet high, and five feet wide. The revolving plates are eight in number and are five feet in diameter, and are made of plate glass. They revolve at a speed of 225 revolutions per minute, being at the rate of about a mile a minute. The stationary plates are straight, and are supported at the ends by suitable supports, which are so arranged as to be adjusted to a nicety.

This machine is charged by a Toepler machine, which is contained in the same case.

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